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THE 17 3/4- AND 18 1/5-YEAR CYCLES IN VARIOUS PHENOMENA

by Edward R. Dewey, Director
Foundation for the Study of Cycles

IT WOULD be neat if I could tell you that there is a cycle exactly 18 years long in sunspots, weather, tree rings, crops, animal abundance, and economic activity. It would be neater still if I could say, more or less after Jevons, that crests of this cycle occur first on the sun, then in weather, then in crops, and lastly in human activity--thus suggesting a series of cause and effect relationships. It would be neat, but it would not be true.

Cycle about 18 years in length have indeed been observed in many phenomena, as I shall presently set forth in more detail. However it seems quite clear that the so-called 18-year cycle is not just one cycle, measured with varying degrees of accuracy, but at least two distinctly different cycles, and perhaps more.

One of these cycles seems to be a little over 18 years--perhaps 18.2 or 18.3 years--long. The other cycle seems to be between 17 2/3 and 17 3/4 years long. I think 17.7 years is as close as we should try to estimate its length without additional research.

It seems worth while at this time (a) to review some of the evidence for the *existence* of cycles of this length, (b) to compare their *timing* in various phenomena, and (c) to measure their *lengths* as accurately as present techniques and facilities permit. Such a study will marshall some of the evidence which has made me believe that these behaviors are not the result of random forces.

The 18.2-Year Cycle

The 18.2- or 18.3-year cycle is reported upon here in detail only as it is found in the number of sunspots with alternate cycles reversed (1749--1954), in real estate activity (1851--1954), and in the alternate thickness and thinness of tree rings (Tectona grandis) in Java (1514--1929).

However the same cycle has been found in addition in building activity (1830--1945), marriages in St. Louis (1886--1934), acreage planted to wheat in New York State (1880--1930), building construction in Hamburg, Germany (1885--1935), loans and discounts (1833--1936), the sales of a large industrial company (1872--1939), and the sales of a large public utility company (1883--1939). (See page 59.)

Sunspots with alternate cycles reversed, 1749 to date, show clear evidence of a rhythmic cycle about 18 years long. A rhythmic cycle is a variation which repeats time after time with a rhythm or beat. The length of a rhythmic cycle is the average or typical time interval from crest to crest, or from trough to trough. Hence, when we speak of a 18-year *rhythmic* cycle in certain behavior, we mean that the behavior fluctuates in a succession of *waves*, each, on the average, about 18 years long. For an explanation of the term

"sunspots with alternate cycles reversed," see page 46.

This 18-year rhythmic cycle in sunspots with alternate cycles reversed is visible even by casual inspection if you adjust raw values for the dominant 22 1/5-year cycle (see Fig. 3 on pages 48 and 49).

The amplitude (strength) and shape of this 18-year cycle in the sun changes as it would change if the manifest cycle were the result of two cyclic forces closely related to each other in wave length. The lengths of the indicated component forces are about 18.2-years and 17.7-years long respectively.

The series of figures available (1749 to date) is not long enough to enable us to know *for certain* that in postulating two cycles we are not engaging in mere description. However the fact that we find cycles of about these two lengths clearly separated here on earth suggests that the hypothesis of two closely related solar cycles is probably a correct one.

Real estate activity and building activity are two of the terrestrial phenomena which show the 18.2-year cycle most clearly. Lack of space makes it possible to report in detail upon only one of them here. I have chosen to write about the 18.2-year cycle in real estate activity--the number of voluntary real estate transfers.

Real estate activity shows a clear cut rhythmic cycle slightly over 18 years long (see Fig. 1 on page 38). The length is probably quite close to 18.2 years. Crests fall ideally about a year after the crests of the corresponding idealized 18.2-year cycle in sunspots.

The alternate thickness and thinness of tree rings (Tectonis) in Java (1514--1929) likewise show an 18.2-year cycle, but much less convincingly. If tree growth in Java is indeed influenced by a cyclic force of this length, the force is not dominant enough to result in a visible *rhythm.* Under these circumstances one must depend upon the evidence offered by an "average" cycle present in the series as a whole or in its various parts. By itself, this procedure proves very little. It is equivalent to flying by instrument.

Calculation of average cycles fails to show any 17.7-year tendency. However for what it may be worth, it does show an 18.2-year cycle present on the average in each half of the series. This cycle, inverted, turns about 2 1/2 years after the turn of real estate activity.

The timing of this 18.2-or 18.3-year cycle in various phenomena, expressed in terms of the ideal time of the current crest, is given in the following tables:

Phenomena Evidencing 18.2- or 18.3-Year Cycles	Approximate Time of Ideal Crest
Marriage in St. Louis	1960.0
Sunspots with alternate cycles reversed	1960.7
Sales of an Industrial Company	1961.0
Real Estate Activity	1961.8
Sales of a Public Utility Company	1962.0
Building Construction	1963.1
Construction in Hamburg	1963.8
Java Tree Rings (inverted)	1964.4
Acreage planted to Wheat in N. Y. (inverted)	1966.3
Loans and Discounts	1966.8

The 17.7-Year Cycle

As stated above, some series of figures are characterized by a cycle about 17 2/3 or 17 3/4 years long in addition to or instead of the 18 1/5- or 18 1/3-year cycle.

In a series of any considerable length there is no possibility of mistaking the two. In ten cycles for example the overall length, measured from the first cycle to the last, would be 177 years for the 17.7-year cycle, 182 years for the 18.2-year cycle. A difference as great as this --5 years--can scarcely be confused. Then too, the 17.7-year cycle tends to come earlier, both on earth and on the sun.

A simple separation of the two cycles, where they are both present in the same series of figures, would require 645 years of data. To get the exact length of either, when both are present, would require a minimum of 350 additional years. This makes a total of 1000 years of figures. There are not many series as long as this.

This paper will report upon the 17.7-

year cycle as it is found in the liabilities of commercial and industrial failures (1857--1954), in sunspots with alternate cycles reversed (1749--1954), in pig iron prices (1784--1954), in the alternate thickness and thinness of Arizona tree rings (A.D. 931--1939), in cotton prices (1731-2--1953-4), in war (599 B. C.--A.D. 1945), and in Chinese earthquakes (A.D. 54--1651).

The evidence for a 17.7-year cycle in sunspots with alternate cycles reversed has already been discussed.

For tree rings and for Chinese earthquakes we must depend upon the existence of average cycles in each half of the data.

Let me say again that when we determine the *average* cycle of a given length in a series of figures we do not prove that a cycle of that length is present. We merely show the timing and strength of the cycle, *if* present in the original figures.

When we find the given cycle in each half of the series of figures we get, in addition, a measure of its exact length, *if* it is present.

Proof that the average cycle is not the result of random forces must come from additional criteria.

With cotton prices, pig iron prices, and failures, the situation is quite different. Here the 17 3/4-year cyclic force dominated sufficiently so that the resultant cycle is visible as a rhythm. This is much more satisfactory and convincing, even if the figures evidencing this behavior do relate to human rather than to physical phenomena.

(I say *even* if they relate to human behavior because, in some quarters, there is a prejudice against recognizing that human beings, too, seem to respond to natural environmental forces. Also some physical scientists and some biologists tend to belittle social science data. One distinguished British ecologist said recently (privately), that investigations which included the study of economic data could not even be called scientific.)

As with the 18.2-year cycle, it may be in point to tabulate the various phenomena evidencing the 17 2/3--17 3/4-year cycle, and to give the approximate dates of their current ideal crests.

Phenomena Evidencing 17 2/3- or 17 3/4-Year Cycles	Approximate Time of Current Ideal High
Liabilities of Commercial and Industrial Failures (inverted)	1954.7
Sunspots with alternate cycle reversed	1955.8
Pig Iron Prices	1956.3
Cotton Prices	1958.9
Civil War & International War Battles Combined (inv.)	1959.7
Earthquakes in China	1960.2
Arizona Tree Rings	1961.7

The 17.7- and 18.2-Year Cycles Not Present

A number of time series were studied which failed to show any evidence of any cycles from 17 2/3 to 18 1/3 years in length. These series are as follows:
Wrought Iron Prices in England, 1277--1918.
Flood Stages of the Nile, A.D. 622--1921.
Population of the U. S., 1790--1952.
Lake Sakski Varves, 2295 B.C.--A.D. 1894.
Copper Prices in the U. S., 1784--1952.
U. S. Immigration, 1820--1952.

Implications

The implications of this investigation are, it seems to me, as follows:

First, if we may deduce a cause where we are able to see an effect--there is evidence of the existence of environmental forces with wave lengths (periods) close to 17.7 and to 18.2 years respectively.

Second, because there is evidence of cyclic forces of the same length operating upon the sun, we can suppose that these forces may be extra-terrestrial.

Third, so that we may know for certain whether this behavior is significant or merely random, further research is called for. If the behavior is not merely random we must learn what causes these rhythmic cycles and just what are the mechanics of their operation.

Details on Following Pages

The above remarks are a summary of the research which is reported upon in detail on the twenty-three pages which follow.

THE 18.2-YEAR CYCLE IN REAL ESTATE ACTIVITY, 1851—1954

A REMARKABLY regular cycle about 18.2 years long has been present in real estate activity from the first available figures (1851) up to the present time. Since the beginning of World War II, however, this cycle has been somewhat distorted.

"Real estate activity" is a term used to denote the number of voluntary real estate transfers. An index of such transfers in major U. S. cities from 1851 to date, adjusted for trend, has been prepared and is kept up to date month by month by The Roy Wenzlick Company of St. Louis, Missouri. A wall chart of their index is published annually.[1]

Fig. 1 below gives annual values estimated from the monthly values given on the wall chart. Fig. 1 also diagrams a perfectly regular 18.2-year pattern. Conformity to the pattern for the first 5 cycles is marked.

For the period 1851-1946 the 18.2-year cycle had an average strength of 37% above trend at year of crest; 41% below trend at year of trough.

As nearly as can be determined in a series of figures as short as this, the length of the cycle is a shade over 18 years long. This fact is illustrated in Fig. 2 in which the successive 18 year waves are repeated one under the other.

In a series as short as this it is impossible to know whether or not a 17 2/3- or 17 3/4-year cycle is also present.

Assuming the cycle to be 18.2 years long, crests come ideally at 1852.0 and every 18.2 years thereafter. This puts the next crest due ideally at 1961.8. However, as this cycle has been somewhat distorted since the beginning of World War II, we should await evidence of its reappearance before attempting to use it to throw too much light upon the probabilities of the future.

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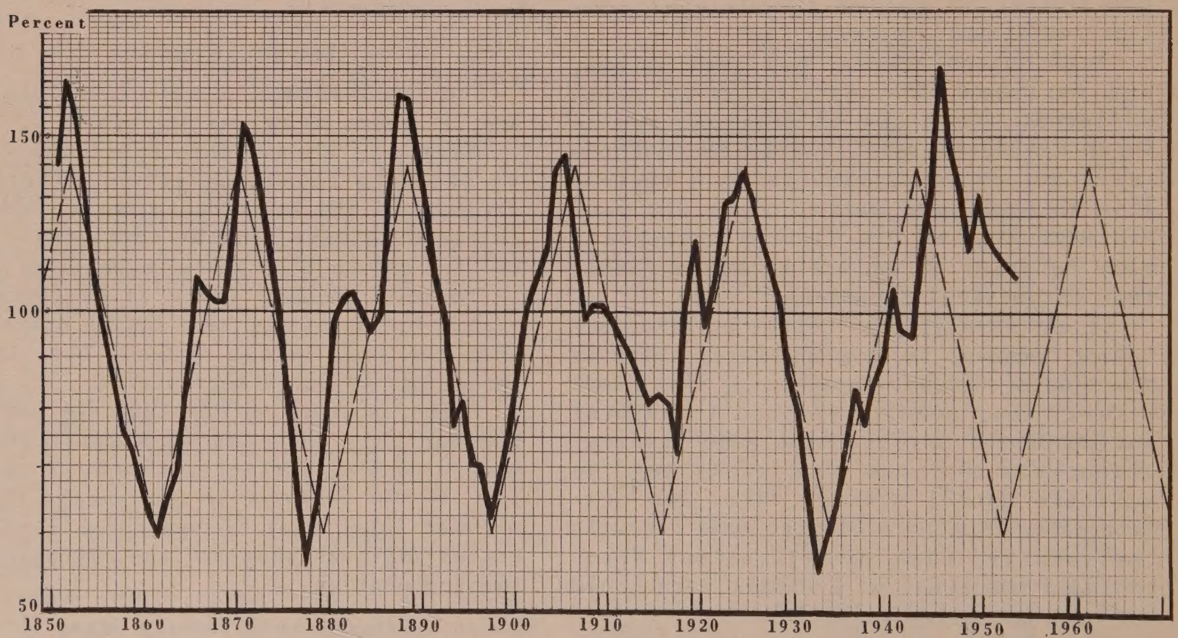

Fig. 1. Real Estate Activity, 1851--1954.

Percentages above and below trend as read from a chart of monthly values adjusted for trend, published by The Roy Wenzlick Co. of St. Louis, Mo. The broken line diagrams a perfectly regular 18.2-year cycle.

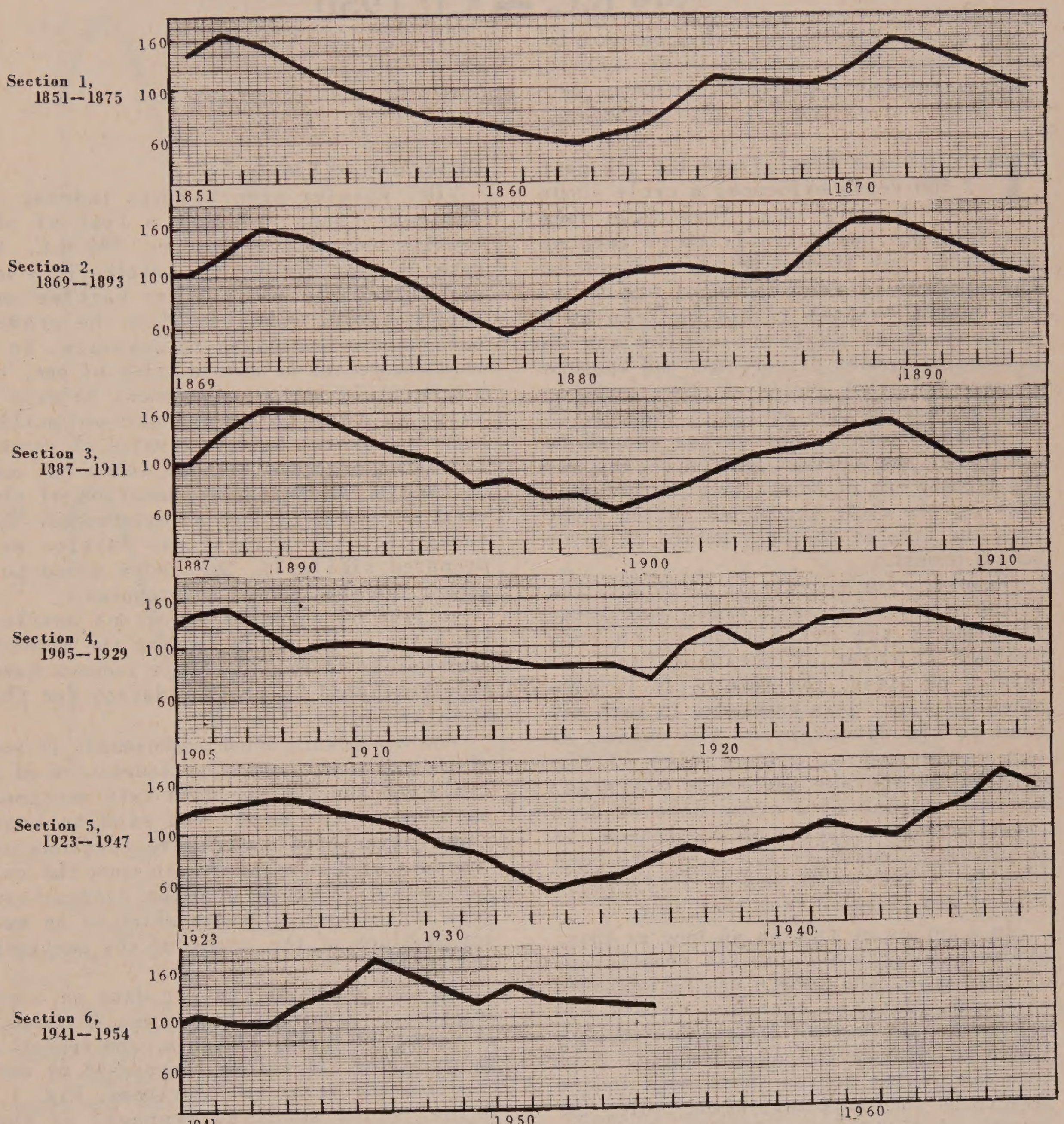

Fig. 2. The 18.2-year Cycle in Real Estate Activity, 1851--1954.

This chart shows the data cut into sections each starting 18 years later than the one before.

The successive cycles can, by this expedient, be compared more easily.

THE 17¾-YEAR CYCLE IN WAR, 599 B.C. — A.D.1950

THE ebb and flow of war for the past 2,500 years evidences a cycle about 17 3/4-years long. This cycle does not dominate sufficiently to be seen as a rhythm, but it is clearly present on the average in each third of the data. The reason that it cannot be seen as a succession of rhythmic cycles may be because of random distortions and because of more important cycles of other lengths, also present in this series of figures.[1-8]

As the cycle is not strong enough to dominate, the timings of its crests and its troughs are of no practical importance. That is, the cycle throws but little light upon the time of the next period of major social unrest.

However, for scientific purposes, the timing of the cycle is of great importance. It enables the cycle student to know whether it comes at the same time, or before, or after, the same cycle in some other behavior. This knowledge in turn may lead to the discovery of the causes of the cycle and to a knowledge of the mechanisms whereby the cycle operates. Accurate timing of a cycle depends upon accurate determination of its length. If we assume a length of 17.73, crests come ideally at 266.5 A.D. and at 17.73 years forward and backward from that date.

In a series of figures as long as this, offering opportunity for 144 repetitions of the cycle, the length can be measured with considerable accuracy unless the series is influenced by another cyclic force of nearly the same length. With this particular series there does indeed seem to be such an interferring cycle. The length of 17.73 years is therefore advanced only tentatively.

It seems desirable to say a word in regard to the data. We constructed an index of *war* by combining the separate indexes of international battles and of civil war battles prepared in 1943 by Raymond H. Wheeler. At the time he did the work, Dr. Wheeler was Professor of Psychology at the University of Kansas.[8,9]

Dr. Wheeler prepared his indexes as follows: First, he made a list of all battles recorded in history, 599 B.C. to date. He next divided the battles into two main categories—civil war battles and international battles. Then, he graded each battle according to severity. To a mild engagement he gave a value of one; to a moderately severe engagement he gave a value of two; to a very exceptionally heavy engagement he gave a value of three. The value of the civil war index for any particular year is the summation of the civil war battle values so determined. The index of international war battles was prepared similarly. Our index added together the two indexes so prepared.

A list of the more important battles and a series of charts showing the year by year values of Dr. Wheeler's indexes have been published by the Foundation for the Study of Cycles. [9]

And now a word about techniques: If you wish to determine the characteristics of a cycle you can cut the data into sections as long as the cycle you wish to know about. Averaging successive sections of the data will have no effect upon the cycle, but will minimize other cycles (except cycles with a length which is an exact fraction of the length of the section) and randoms.

In our study of the war data we used sections 17 3/4 years long (i.e., 18 years, 18 years, 18 years, 17 years, and repeat). We converted all values (increased by one to eliminate zero) to logarithms. Fig. 1, below, shows smoothed averages of the first 60 sections 248 B.C. -- 817 A.D., and the next sixty sections, 818 A.D. — 1882 A.D.

The average strength (amplitude) of the cycle is 109.0% of trend at time of crest, 91.4% of trend at time of trough. The fact that the cycle slips slightly to the left in successive sections shows that it is slightly shorter than 17.75 years. The

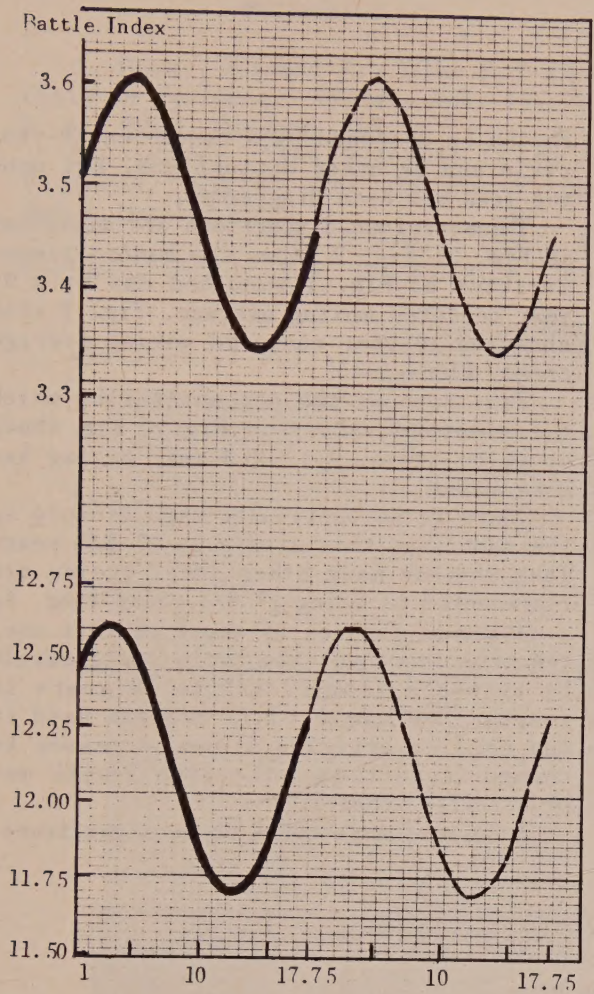

Fig. 1. The 17.73-Year Cycle in War, 258 B.C.—A.D. 1882.

Upper curve: average of the first sixty 17 3/4-year cycles (248 B.C.—A.D. 816), smoothed and repeated in phantom. Ratio Scale.

Lower curve: average of the second sixty 17 3/4-year cycles (A.D. 818—1882), smoothed and repeated in phantom.

Unsmoothed figures have 2.3 times the amplitude shown.

The fact that the second sixty cycles come slightly earlier on the grid suggests a length of 17.73 years.

amount of the slippage indicates a length of 17.728 years.

The evidence suggests the possibility of some periodic environment disturbance, perhaps an ultralong energy wave, which has an effect upon man's natural warlike tendencies.

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THE 17 2/3-YEAR CYCLE IN FAILURES, 1857—1954

THE liabilities of commercial and industrial failures in the United States, 1857 to date, are characterized by a definite and very pronounced rhythmic cycle of 17 1/2 to 18 years in length.

There are many other rhythmic cycles also present in this series of figures.[1-4] There are also many non-rhythmic or random factors. Therefore, perhaps the most that can be said at the moment is that the liabilities for the 9 years centering on 1954 will be substantially below trend, and that the liabilities for the nine years centering on 1964 will be substantially above trend, if this cycle in these figures continues.

My discovery of this rhythm was discussed in detail in a paper in the Autumn 1951 *Journal of Cycle Research.*[5] Readers should refer to that paper. This article serves merely to bring the earlier paper up to date.

Fig. 1 below shows actual liabilities, 1857—1954. The underlying 17 1/2—18-year rhythm is obscured by a concurrent 9-year cycle and by other distortions, but none the less has been diagrammed.

These various distortions are minimized in Fig. 2. Fig. 2 shows the minor irregularities of Fig. 1 smoothed out by a 9-year centered moving average. Fig. 2 also shows an 18-year centered moving average trend, 1866—1945.

Fig. 3 shows the percentages by which the smoothed values in Fig. 2 are above or below trend. A 17 2/3-year zigzag has been added.

There is no particular significance in the fact that this zigzag is 17 2/3 years long whereas many other ideal cycles are represented as being 17 3/4 years long. In a series of figures as short as this one, the true length of the cycle could easily be anywhere from 17 1/2 to 18 years in length. The length of 17 2/3 was used in the earlier article. I see no reason to change it,, although the true length may be a trifle longer.

I believe this cycle to be significant.

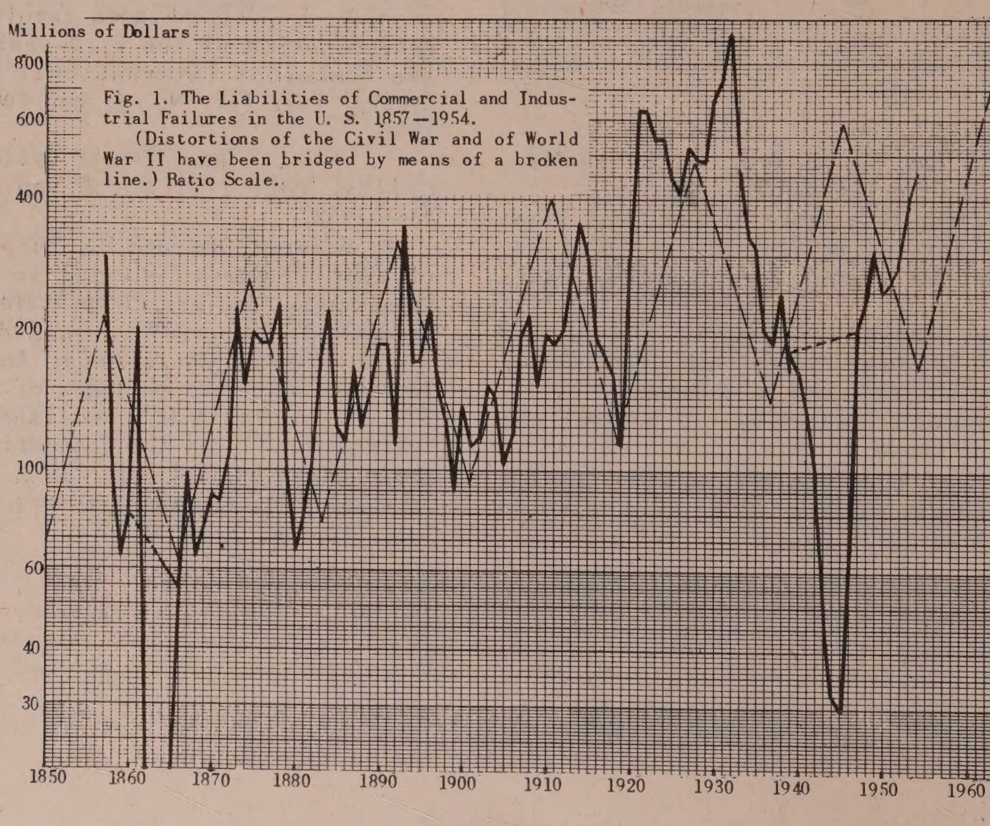

Fig. 1. The Liabilities of Commercial and Industrial Failures in the U. S. 1857—1954.
(Distortions of the Civil War and of World War II have been bridged by means of a broken line.) Ratio Scale.

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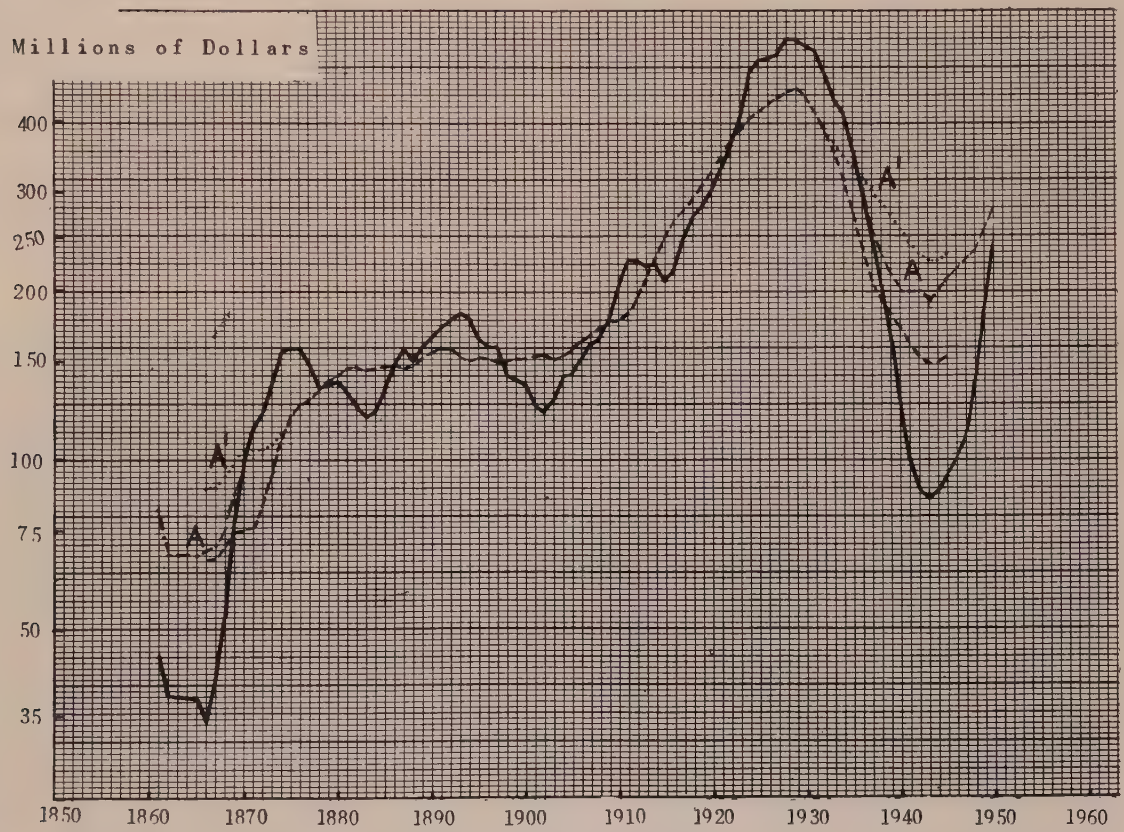

Fig. 2. The Liabilities of Commercial and Industrial Failure in the U. S. 1857—1954, smoothed by means of a 9-year geometric moving average. Together with an 18-year geometric moving average of the data (shown by means of a broken line). The dot and dash lines at either end of the 9-year moving average marked A represent the 9-year moving average values obtained by using adjusted values for the Civil War and World War II periods. The dotted lines at either end of the 18-year moving average marked A' represent the 18-year moving average values obtained by using adjusted war values.

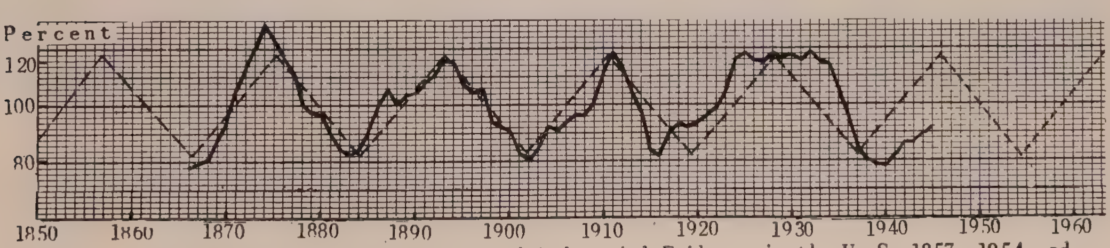

Fig. 3. The Liabilities of Commercial and Industrial Failures in the U. S. 1857—1954, adjusted for Civil War and World War II distortions, smoothed by a 9-year geometric moving average, and expressed as percentages from their 18-year geometric moving average. Ratio Scale.

THE 17¾-YEAR CYCLE IN COTTON PRICES, 1731-2—1953-4

COTTON prices for over 220 years have been characterized by a rhythmic cycle about 17 3/4 years in length. This fact can be seen by inspection of Fig. 3 below. Fig. 3 is reproduced from an earlier paper which shows charts of cotton prices, both adjusted and unadjusted, both smoothed and unsmoothed.[1] Fig. 3 shows cotton prices adjusted for the Civil War, for inflation, and for trend, and smoothed to minimize minor fluctuations.

The following are excerpts from the paper referred to:

The cycle is nearly twice as strong as is shown by the solid line in Fig. 3. This is so because the smoothing process eliminates about half of the cycle.

The typical cycle crests ideally in November 1745 and every 17.75 years thereafter. This would put the present cycle on the way up, due to reach its crest November 1958. Of course there is no likelihood that the crest of *actual* cotton prices will come then. It will surely come earlier or later. (January 29th is *ideally* the coldest day of the year for New York City, but the chance that *this* winter's coldest day will come on that day is slim.)

Ideally, the typical cycle has a strength of about 19% above trend at top, about 16% below trend at bottom. This means a move of about 35% of trend overall

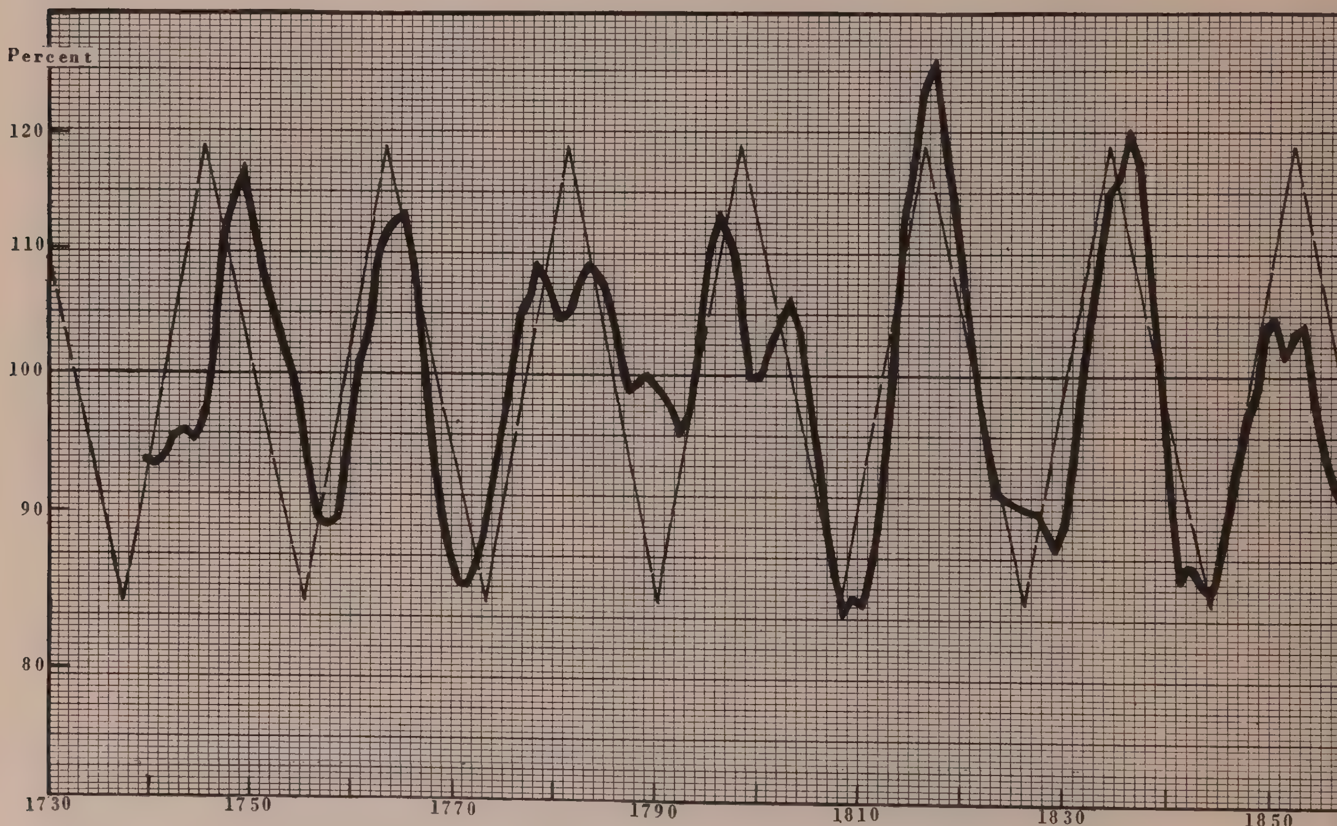

Fig. 3. The 17 3/4-Year Cycle in Cotton Prices.

This curve shows the amounts by which the smoothed cotton prices have been above or below trend. Gold values used from the New Deal forward.

in about 9 years, or about 4% of trend a year

You must not think of this cycle (or any other cycle) in terms of its ideal crest. Think of it rather in terms of *areas* of strength and *areas* of weakness. From this point of view, from now to 1962 or 1963 should be, *on the average*, above trend. The nine years to follow should, *on the average*, be below trend.

In the past we have had eleven complete cycles. Of the 22 tops and bottoms in the smoothed figures (adjusted to a gold basis and for the Civil War, expressed as percentages from trend) we have the following record: Fifteen came on time or within 2 years of perfect timing. Four came 3 years one way or the other of perfect timing. One was 4 years off. One was 5 years off.

We cannot yet speak with certainty regarding the present cycle, for the trend cannot be computed past 1945-46, but all indications are that this cycle will be distorted.

In the actual prices the 17 3/4-year cycle cannot be expected to dominate. However, in the past 220 years, out of 24 possible transactions, 20 of them would have resulted in profit; 4 would have resulted in loss. The net profit for the period would have been 685%.

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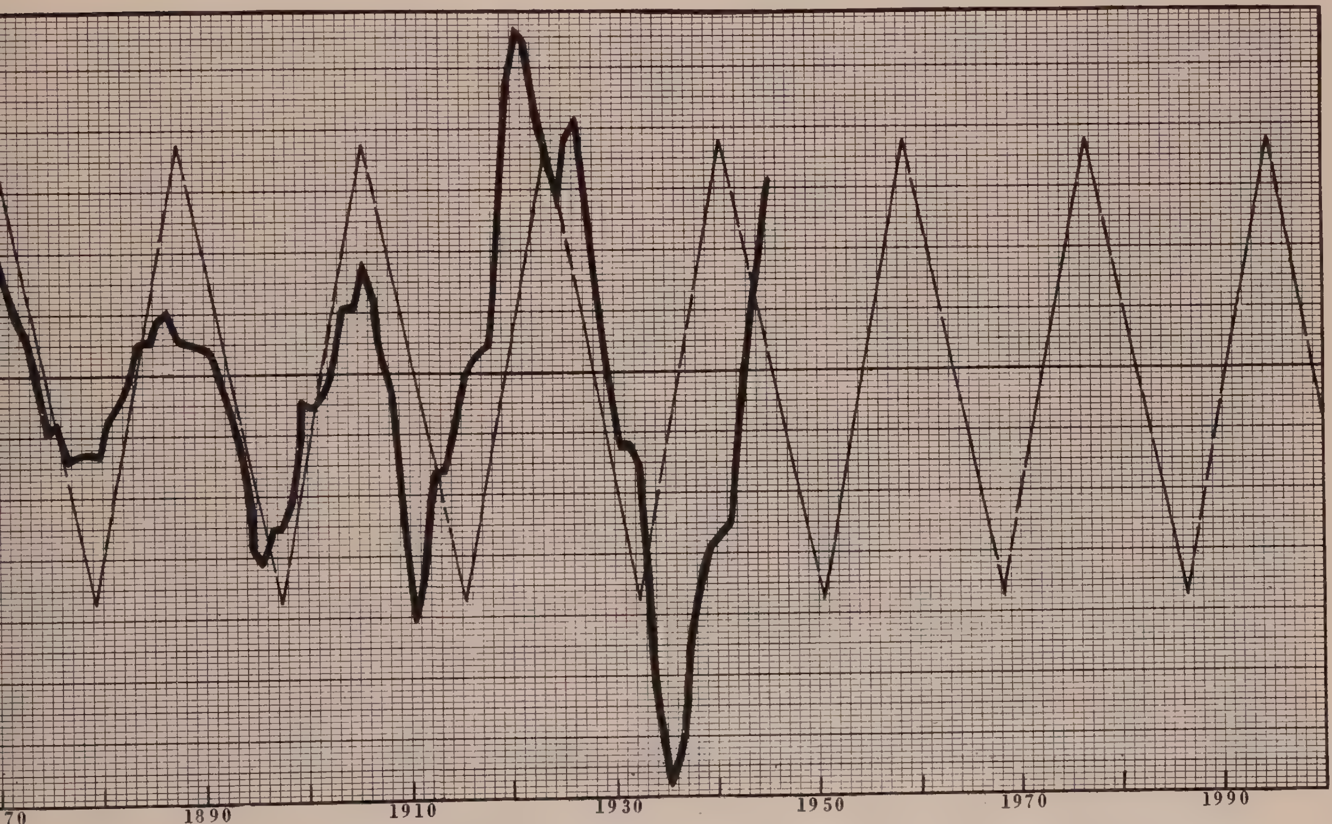

Note that the curve extends only to 1946 because it is impossible to know the values of the trend past that time.

The regular broken zigzag line diagrams the 17 3/4-year cycle. Ratio Scale.

THE 17 2/3-AND 18 1/5-YEAR CYCLES IN SUNSPOTS WITH ALTERNATE CYCLES REVERSED, 1749—1954

SUNSPOTS with alternate cycles reversed, 1749 to date, evidence a definite rhythmic cycle about 18 years in length. As I told you in earlier papers, this rhythmic cycle acts as if it were caused by the joint effect of cyclic forces about 17 2/3 and 18 1/5 years long respectively.[1,2]

First of all let me explain what we mean by "sunspot numbers with alternate cycles reversed." That always puzzles everybody.

To start at the very beginning, sunspots are areas on the surface of the sun which are cooler than the surrounding surface and therefore appear darker. As yet no one knows what causes them.

The number of spots increase and decrease, as you know, in a rhythm which averages a little over 11 years from crest to crest. See Fig. 1.

Also, as you doubtless know, sunspots evidence magnetism. This fact is revealed by the spectroscope. The spots act as if they were north poles or south poles of huge magnets situated within the sun.

Again, sunspots usually come in pairs, a north or "positive" spot associated with a south or "negative" spot.

Finally, in one 11-year cycle in the northern hemisphere of the sun, "negative" or south-seeking spots will tend to lead; in the next 11-year cycle in the same hemisphere, "positive" or north-seeking spots will tend to lead; then the pattern repeats and for the next cycle "negative" or south-seeking spots lead again, and so on. (In the southern hemisphere the situation is reversed.)

About 16 years ago, C. N. Anderson of the Bell Telephone Laboratories said to himself, "If one cycle represents an increase in 'positiveness,' and the next cycle an increase of 'negativeness,' why not use the zero line as an axis and represent the 'negative' cycle below the line?" No sooner said than done, and the chart of sunspot numbers from 1749 through 1954 shown in Fig. 1 becomes a chart of sunspot numbers with alternate cycles upside down, or reversed, as in Fig. 2.[3]

You can see by inspection that the curve represents a rhythmic succession of waves of more or less the same shape and length. The simplest and crudest of measurements indicate that this length is

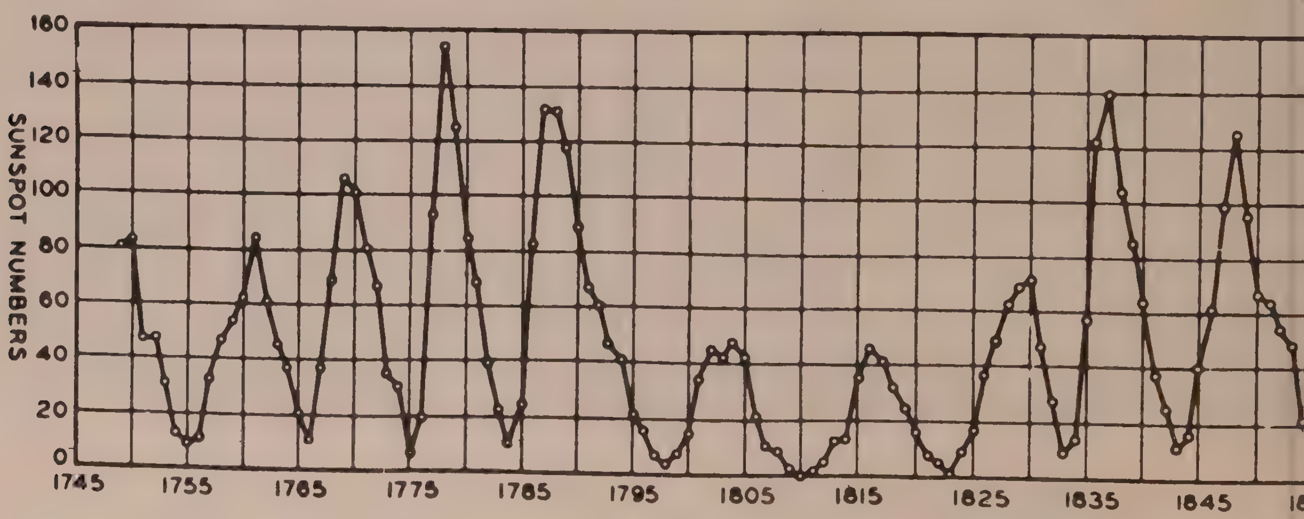

Fig. 1. Yearly averages of monthly relative sunspot numbers, 1749--1954 (after Anderson).

INDEX TO "CYCLES" VOLS. I-V

1950--1954

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FOREWORD

THIS section reprints the cycle length indexes of the first five volumes of *Cycles*, a magazine published ten times a year by the Foundation for the Study of Cycles. It puts into compact form a list of all cycles that have been referred to in that magazine during the period 1950—1954.

In addition to the specific page references, the index is of use to the cycle student in four ways.

First, it enables an investigator to see what cycle lengths have been observed (and mentioned in *Cycles*).

Second, when a cycle is discovered, an investigator can see easily whether or not a cycle of the same length has been discovered by other workers in the same or in other phenomena (and mentioned in *Cycles*). If so he can see in how many and in what different phenomena it has been observed.

Third, by studying the nature of the different phenomena which are characterized by cycles of seemingly identical wave length, the cycle investigator may perhaps get some ideas in regard to the cause of cycles.

Fourth, by noting the different wave lengths which have been observed, it may be possible for some observing investigators to discover inter-relationships among the wave lengths themselves and thus to learn something of the laws which may be presumed to control behavior of this sort.

INDEX TO "CYCLES" VOLS. I-V

1950--1954

Volume I, 1950, Index by Cycle Length

LETTERS REFER TO MONTHS, J FOR JUNE, S FOR SEPTEMBER, O FOR OCTOBER, ETC.

Volume II, 1951, Index by Cycle Length

Volume III, 1952, Index by Cycle Length

Volume IV, 1953, Index by Cycle Length

NOTE: THIS INDEX DOES NOT LIST THE HARMONICS OF THE SYNODIC PERIODS OF THE PLANETS, THE HARMONICS OF THE SIDERIAL PERIODS OF THE PLANETS, OR THE HARMONICS USED BY C. N. ANDERSON TO REPRESENT SUNSPOT NUMBERS WITH ALTERNATE CYCLES REVERSED. FOR THESE CYCLE LENGTHS REFER TO PAGES 144, 144 AND 200-1, AND 148, RESPECTIVELY.

NEITHER DOES THIS INDEX LIST ANY OF THE CYCLES REFERRED TO IN ANY OF THE SUPPLEMENTS. FOR A LIST OF THE CYCLES IN INDUSTRIAL COMMON STOCK PRICES ISOLATED BY VEDDER HUGHEY, REFER TO PAGES 90-3, 128-9, 160-1.

Volume IV, 1953 Continued

Volume V, 1954, Index by Cycle Length

about 22 years.

There are various methods you can use to refine crude measurements in order to get closer approximations to the true average length of the rhythm. One of these is the periodogram. A periodogram analysis of the figures charted in Fig. 2 gives us 22 1/5 years as a first approximation of the exact length of this rhythm, and a zigzag of this length has been added to Fig. 2.

If you now adjust the original curve for this 22 1/5-year wave, just as you might adjust a series of monthly figures for a 12-month pattern of seasonal variation, you obtain the curve shown in Fig. 3. An 18-year cycle is clearly evident, but to aid the eye I have added, by means of a broken line, a perfectly regular 18-year pattern so that you can see departures from perfect timing.

Of the eleven possible repetitions of this cycle nine show good conformity. Two, the first and the eighth, are badly distorted.

You will also note that the crests and troughs, sharp in early years, have of late shown a tendency to be flat. This suggests a compound wave. That is, the behavior suggests that instead of an 18-year wave we really have two waves, one slightly less than 18 years long, and one slightly over this length, which were together in 1780 and have since been pulling apart.

The possibility of a compound wave is further suggested by the shape of an average 18-year wave. Instead of the usual zigzag shape (evidenced by the 22 1/5-year wave for example) we have the flatter top which would appear if in fact the wave were compound.

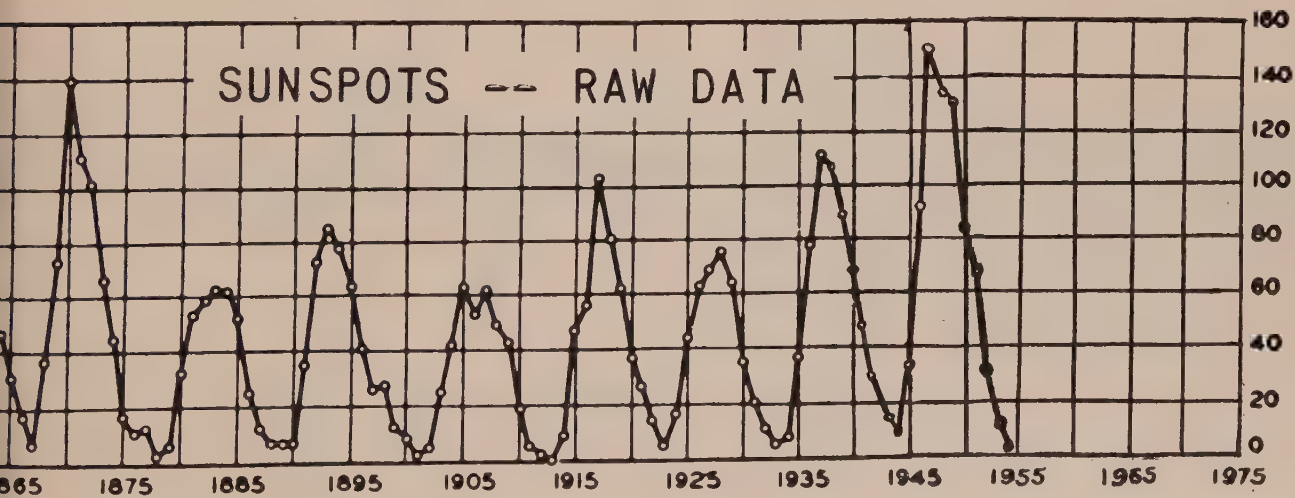
If we construct periodic tables of various lengths we find that as we reduce the length of the table the amplitude and sharpness of the average wave increase until we reach a length of about 17 2/3 years. Similarly as we increase the length of the tables the amplitude and sharpness increase until we reach a length of about 18 1/5 years. This fact gives further support to the idea that we may here be dealing with a compound wave.

References

1. Dewey, Edward R., "Cycles in Sunspots: The 22 1/5-Year Cycle in Relative Sunspot Numbers with Alternate Cycles Reversed, 1749--1949," *Cycles*, Vol. I, No. 1, pp. 8-11, June 1950.

2. -----, "The 18-Year Cycle in Sunspots with Alternate Cycles Reversed," *Cycles*, Vol. I, No. 2, pp. 8-11, September 1950.

3. Anderson, C. N., "A Representation of the Sunspot Cycle," *Bell System Technical Journal*, Vol. XVIII, pp. 292-299, April 1939.



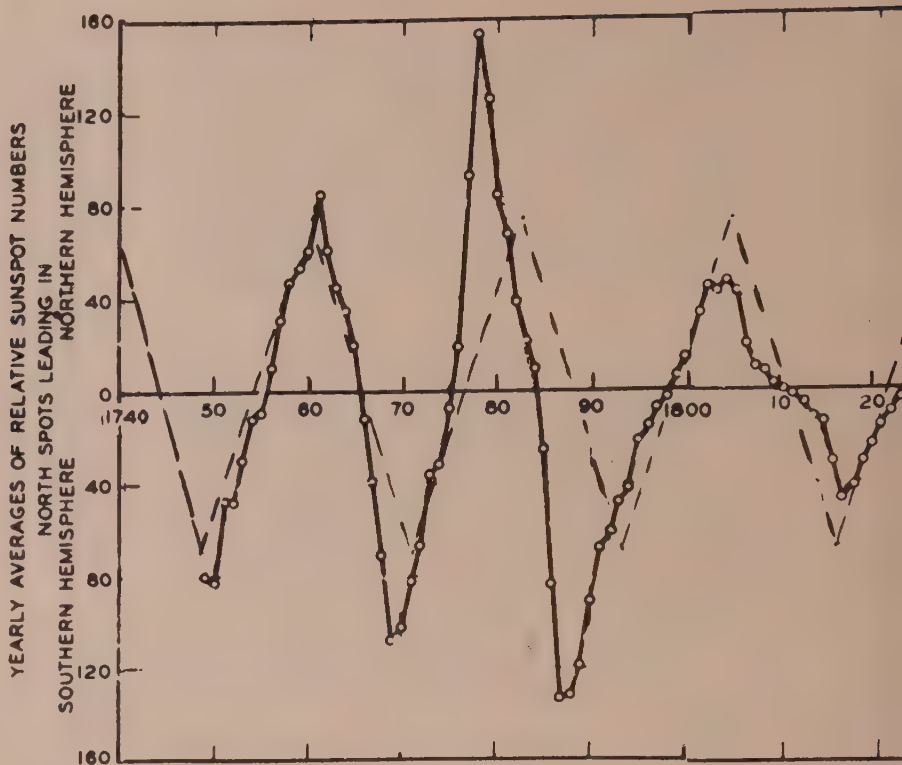


Fig. 2. Yearly averages of monthly relative sunspot numbers, 1749--1954, alternate cycles reversed (after Anderson). Broken line added to diagram the 22 1/5-year rhythm.

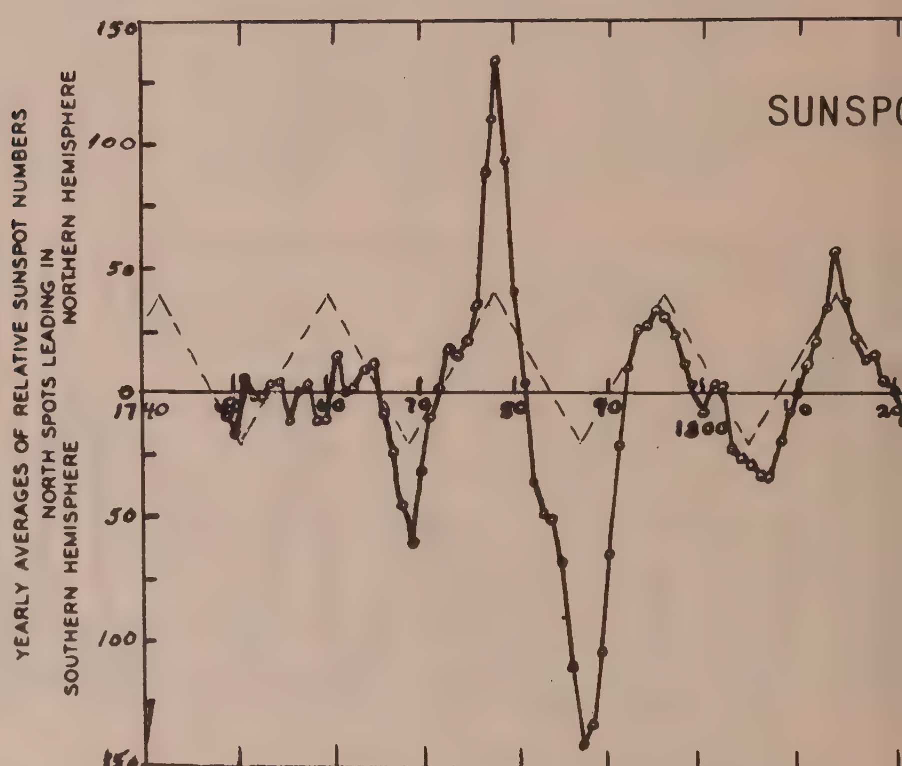
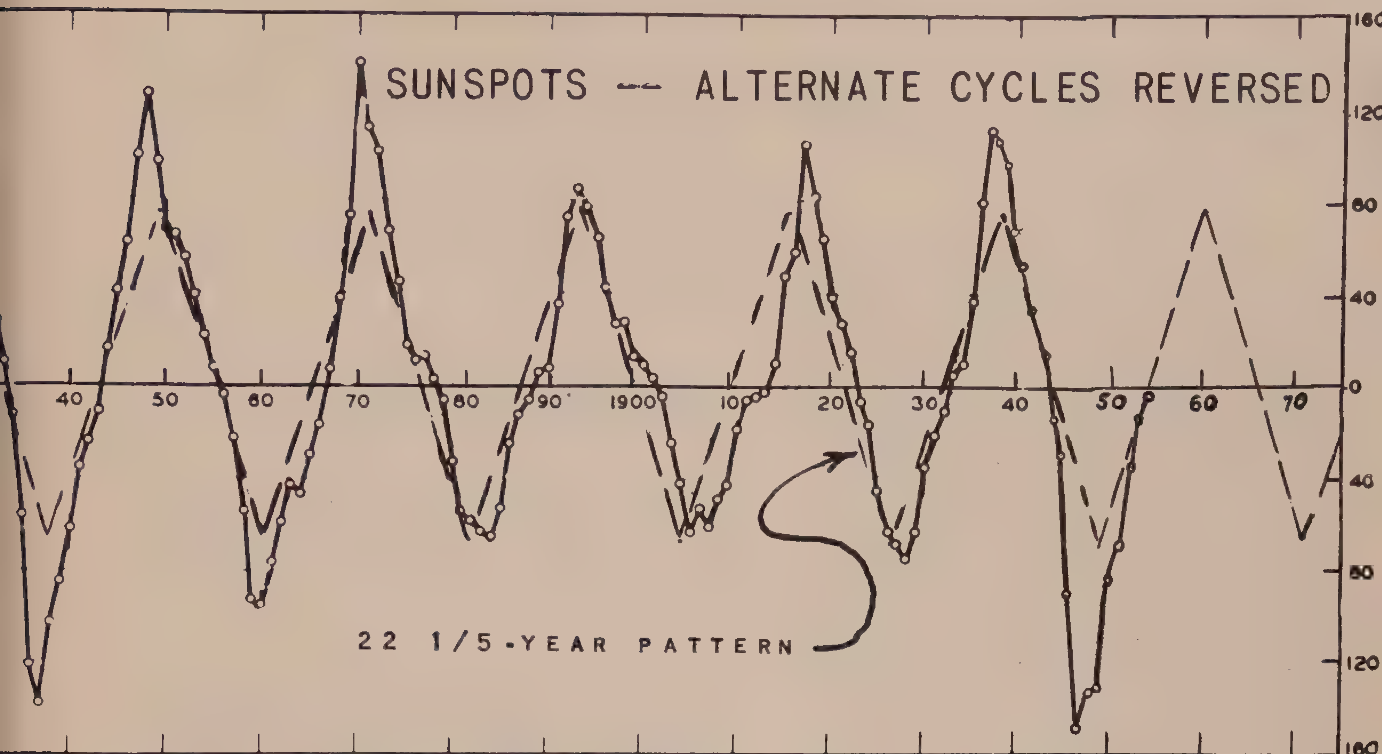
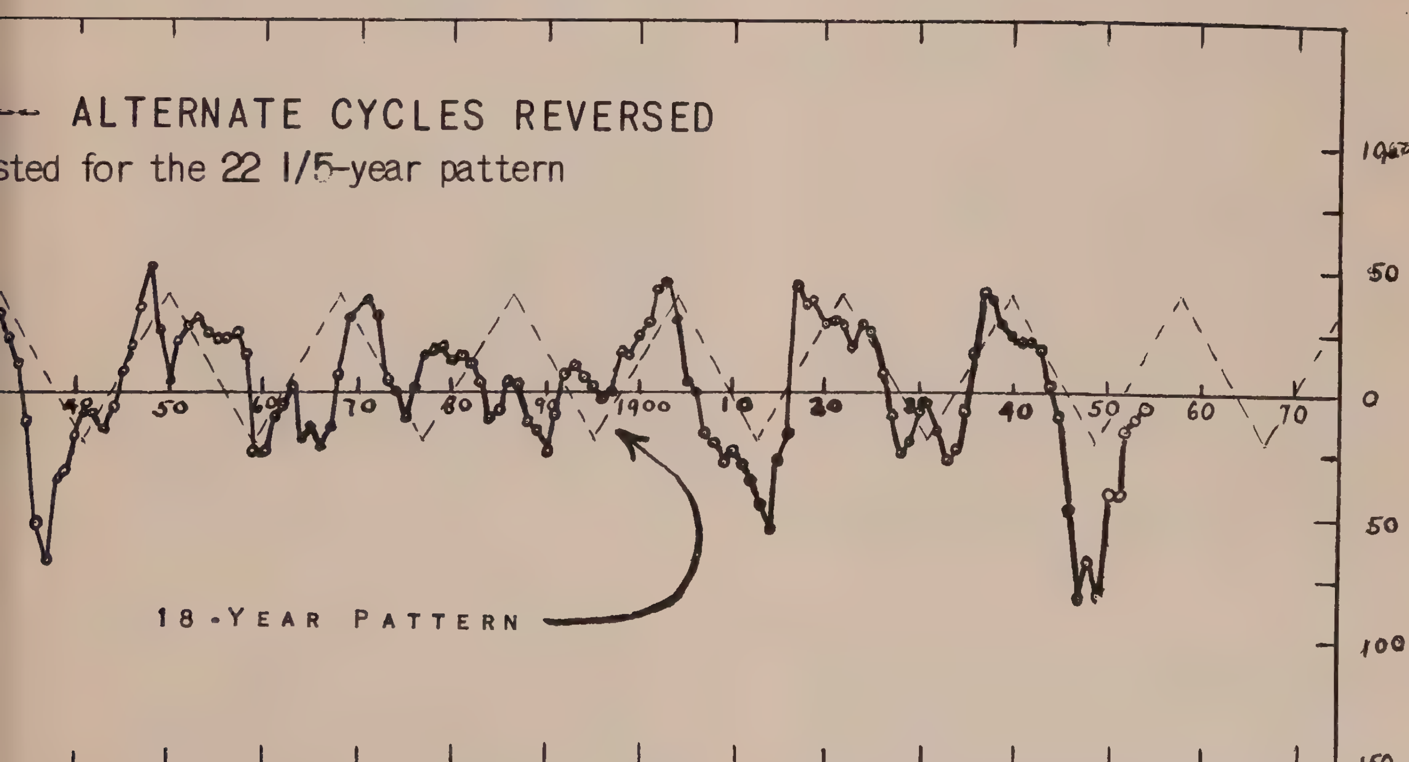


Fig. 3. Yearly averages of monthly relative sunspot numbers, 1749--1954, alternate cycles reversed (after Anderson), after adjustment for the effect of the 22 1/5-year cycle. Broken line added to diagram the 18-year rhythm.


SUNSPOTS -- ALTERNATE CYCLES REVERSED
22 1/5-YEAR PATTERN
40 50 60 70 80 90 1900 10 20 30 40 50 60 70
160 120 80 40 0 40 80 120 160


-- ALTERNATE CYCLES REVERSED
sted for the 22 1/5-year pattern
18-YEAR PATTERN
40 50 60 70 80 90 1900 10 20 30 40 50 60 70
50 0 50 100 150

THE 17 3/4-YEAR CYCLE IN CHINESE EARTHQUAKES, A.D.54–1651

EARTHQUAKES in China, A.D. 54--1651 have, on the average, in each half of the data, a cycle a little less than 17 3/4-years long.

The Data

Earthquakes have been reported in China from 1820 B. C., but reporting was only sporadic until about A. D. 92. A gap in the reporting exists from 195 through 275 due to the Great Rebellion, also.

A number of catalogs of earthquakes are available for the study of periodicities. Upon the advice of Turner[1] I have chosen the one of Hirota.[2] For all practical purposes this catalog stops in 1651.

To minimize the distortions due to the reporting of afterquakes and the possible reporting of the same quake in different provinces, I have prepared an index of earthquakes, based on Hirota, in which each year is given a value of 0, 1, or 2, depending upon whether there were no earthquakes, one earthquake, or two or more earthquakes respectively.

Data prior to A. D. 54 and after A. D. 1651 were eliminated because they were too scattered to be significant. The overall length of the series used is 1,598 years.

Length of 17.66 Indicated

The remaining data, entered into a 17 3/4-year periodic table averaged by halves, and smoothed by 6 and 9-year moving averages (to eliminate cycles of about these lengths, also present on the average) are shown in Fig. 1 below. The fact that the lower (later) average cycle comes a little earlier in time than the upper average cycle suggests a length of 17.66 years.

If this is the true length of this cycle the time of the current crest is, ideally, 1960.16 (end of February 1960).

Strength

The strength of the cycle is 2.33 times the strength shown in the chart, for, if the cycle is of the usual zigzag shape, the smoothing cuts down the amplitude by 57%. This means that the amplitude is 11 1/2% above and below the mean for the first 45 cycles, 12 1/2% above and below the mean for the second 45 cycles.

Whether or not the cycle so found is really significant must be established by other means. For the 17 2/3-year cycle in earthquakes this has not yet been done. However, from a study of the data I am inclined to believe that earthquakes in China are indeed characterized by a tendency of this sort.

References

1. Turner, H. H., "Note on the 284-Year Period in Chinese Earthquakes," *Mon. Not. Roy, Astr. Soc., Geogh. Suppl.*, Vol. I, No. 6, 1925.

2. Hirota, Shinobu, "Number of Earthquakes Per Year in China," Report of the British Association for the Advancement of Science, 1908, as copied by G. N. Rebout, 1955.

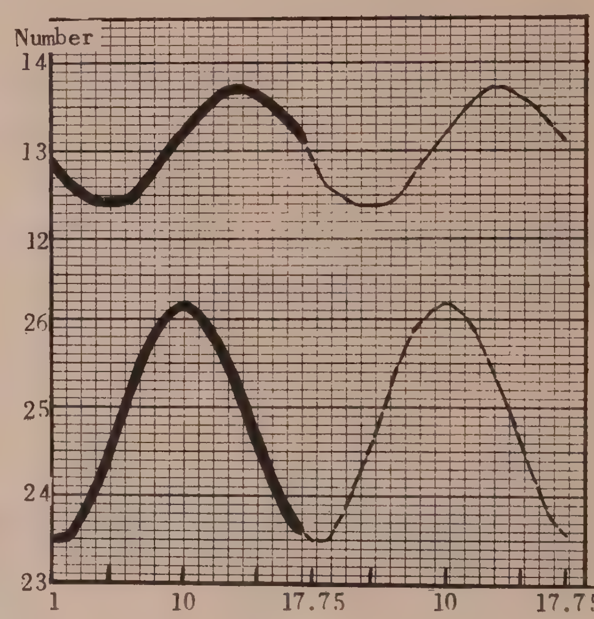


Fig. 1. The 17.66 Year Cycle in Chinese Earthquakes.

Upper curve: average 17 3/4-year cycle A.D. 54--852, smoothed by 9- and 6-year moving averages, repeated in phantom.

Lower curve: average 17 3/4-year cycle A.D. 853--1651, smoothed by 9- and 6-year moving averages, repeated in phantom.

The fact that the cycle in the second half of the data falls slightly to the left suggests a length of 17.66 years.

THE 17¾-YEAR CYCLE IN PIG IRON PRICES, 1784–1954

PIG iron prices, 1784 to date, have been characterized by a rhythmic cycle about 17.7 years long. The span of time for which data are available (171 years) is enough for nine and a half repetitions of the cycle.

I have already reported in detail in regard to this cycle.[1] This report will refine the earlier report and bring it up to date.

The data used are those of the index of the Foundation for the Study of Cycles.[2]

Pig iron prices act as if they were influenced by a number of other cyclic forces, also. Some of these are shorter, some longer, than 17.7 years. The shorter cycles can be fairly well eliminated or minimized by smoothing the raw data by means of a nine-year moving average. See Fig. 1.

As for the longer cycles, the most obvious is the one with crests about 53 years apart (1815, 1868, 1921). However, with so few repetitions it is impossible to know whether or not this behavior is a significant recurrent rhythmic cycle or a mere oscillation. At all events, whatever it is, it can be thought of as trend and treated accordingly. (To definitize trend I used an 18-year moving average, because a moving average of this length completely removes any 18-year cycle. Thus, when percentages above and below trend are computed, there is a minimum of distortion. The 18-year moving average trend is plotted as a broken line in Fig. 1. The smoothed data, free from trend, are shown in Fig. 2.

As you can readily see, we start out with two good cycles. Then, between 1820 and 1850 we have a period of distortion. An extra wave is present. However, for the six cycles from 1850 to date, the behavior reverts to the regularity with which it started.

Since my work of 1952 additional work has been done using quarterly instead of annual data.

This additional work indicates that the true length of the cycle is a shade less than the length of 17.75 indicated by the work with annual figures. As nearly as I can determine it, the length of this cycle in pig iron prices is 17.69 years (70.75 quarter-years) long.

Its crest comes ideally mid-February 1797 and every 70.75 quarter-years forward from that time. This puts the current crest ideally 3rd week of April, 1956, provided of course that the length really is 17.69 years.

The amplitude of this 17.7 year cycle is, on the average, 20% above trend at time of crest, 16.9% below trend at time of trough.

References

1. Dewey, Edward R., "The 17 3/4-year Cycle in Pig Iron Prices, 1784--1951," *Journal of Cycle Research,* Vol. I, No. 3, pp. 76-86, Spring, 1952.

2. Malinowski, Alla, "Pig Iron Prices in the United States, 1784--1951," *Journal of Cycle Research,* Vol. I, No. 3, pp. 68-73, Spring 1952.

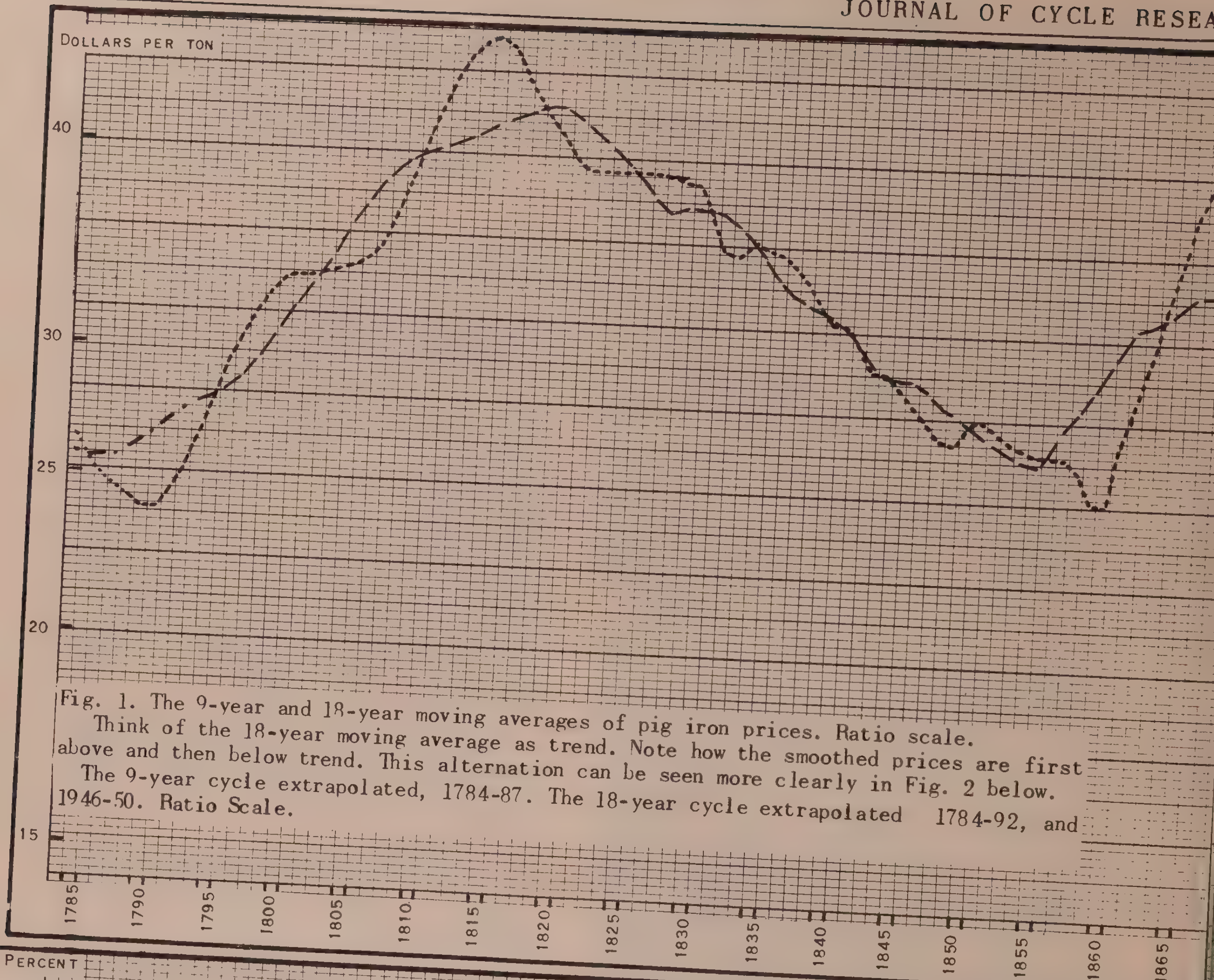


Fig. 1. The 9-year and 18-year moving averages of pig iron prices. Ratio scale.
Think of the 18-year moving average as trend. Note how the smoothed prices are first above and then below trend. This alternation can be seen more clearly in Fig. 2 below.
The 9-year cycle extrapolated, 1784-87. The 18-year cycle extrapolated 1784-92, and 1946-50. Ratio Scale.

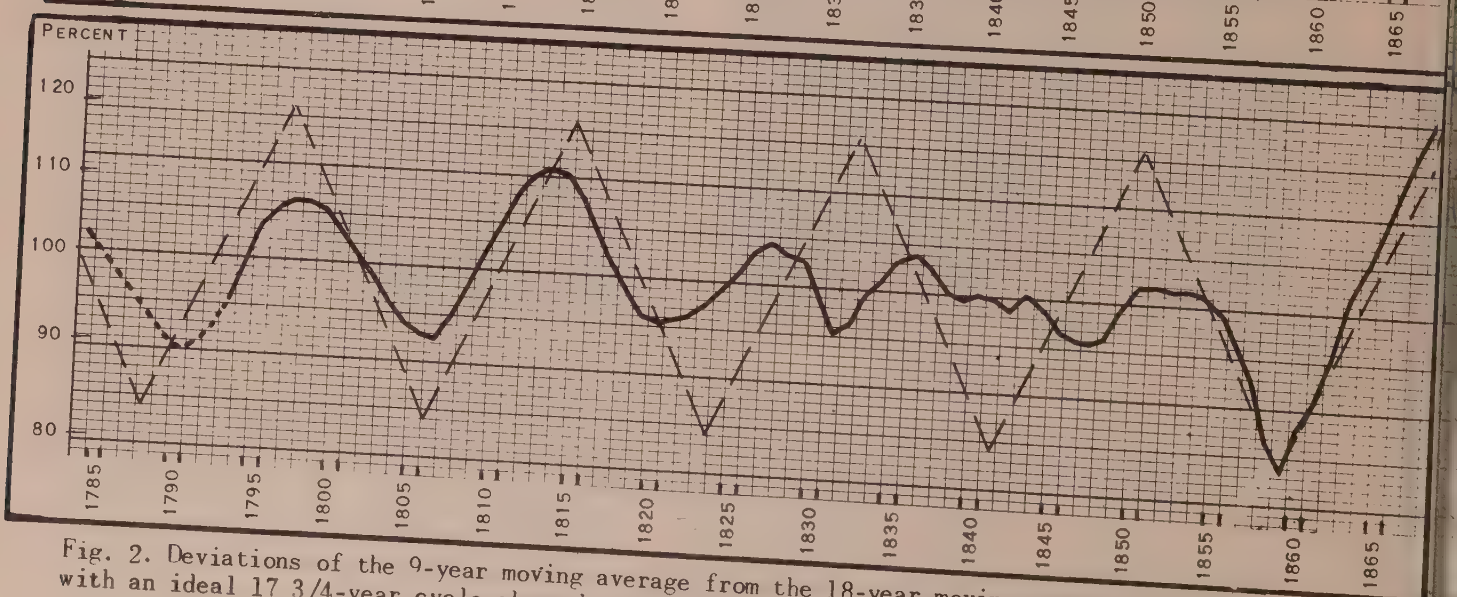
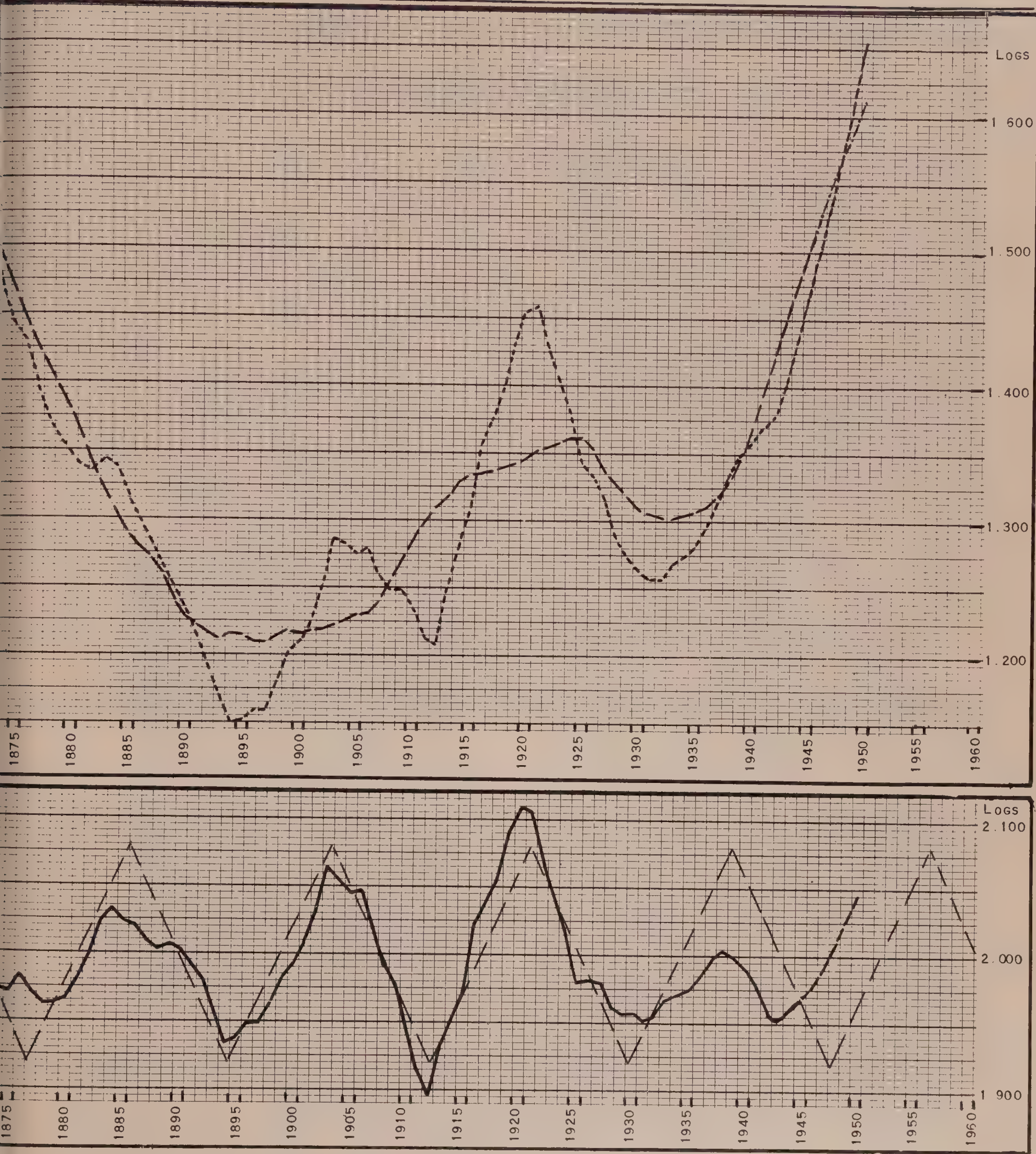


Fig. 2. Deviations of the 9-year moving average from the 18-year moving average, together with an ideal 17 3/4-year cycle shown by means of a zigzag line. Ratio Scale.
The ideal 17 3/4-year cycle has been projected into the future to show in a general way what will happen if this cycle continues.



This chart is the same as Fig. 1 except that the 18-year moving average trend has been "pulled straight" and used as an axis.

The last trough in the ideal cycle occurred at 1947.4 The next crest is due at 1956.3 (January 1, 1957)

THE 18.2-YEAR CYCLE IN JAVA TREE RINGS, 1514–1929

TREE ring widths in Java are alternately wider and narrower in a cycle about 18.2 years long. This cycle is present in these figures from 1514 A.D. through 1929. The 18.2-year cycle does not dominate the tree ring measurements to the extent of creating rhythmic 18-year waves. However, it can be detected easily if we cut the data into sections 18.2-years long, and average the successive sections. Such a manipulation has no effect upon any 18.2-year cycle present in the figures, but it does serve to minimize other cycles and randoms.

The data used in this study were gathered and published by Berlage[1] in 1931; republished by de Boer[2] in 1951. Only de Boer's paper is available to me. The data are tree ring measurements of Tectona grandis in Java and are averages of from 10 to 89 measurements per year. They are presumably in millimeters, although de Boer's paper does not so state. They are recorded to three or four significant figures.

Because tree rings get narrower as trees get older, de Boer adjusted the data for long term trend. It is the figures so adjusted that were used in this study.

Fig. 1 below shows two curves. The upper curve is the smoothed average of the first twelve 18.2-year sections. The lower curve is the smoothed average of the remaining eleven 18.2-year sections. In each case the smoothing was effected by 9- and by 6-year moving averages so as to eliminate the effect of cycles about 9 and about 6 years long, also present on the average in each half of the series. The fact that the cycle in each of the two halves of the data come directly under each other confirms the length of 18.2 years. (However it does not prove that the behavior is significant.)

The 18.2-year cycle in Java tree rings has an amplitude of 4.2% of trend at time of crest, 1.9% of trend at time of trough. Of course the smoothed values shown in the chart have a smaller amplitude because of the smoothing process. If the shape of the original cycle was zigzag, as is usually the case, the reduction of amplitude amounted to 57%.

If the length of the cycle is 18.2 years long, crests come at 1518.5 and every 18.2 years thereafter. This timing puts the current time for wide rings ideally at 1955.3, the current time for narrow rings ideally at 1964.4.

References

1. Berlage, H. P. Tectona, 24, 939 (1931), as referred to in 2 below.

2. de Boer, H. J., "Treering Measurements and Weather Fluctuations in Java from A. D. 1514, I and II," reprinted from *Proceedings*, Series B, Vol. LIV, No. 3, 1951, Koninklijke Nederlandse Akademie Van Wetenchappen.

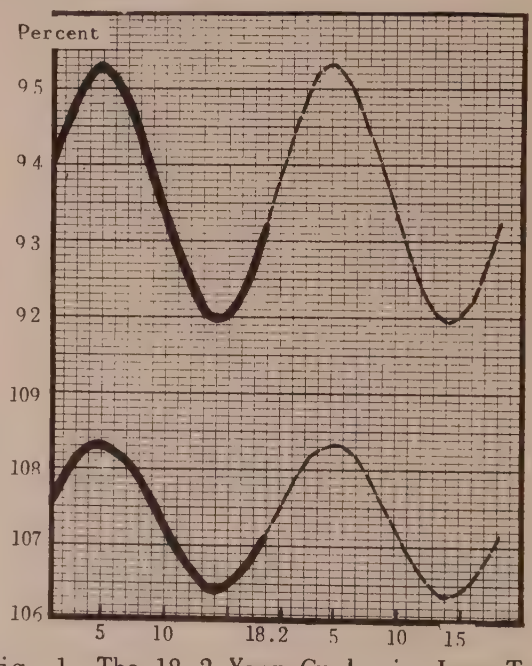


Fig. 1. The 18.2-Year Cycle in Java Tree Rings.

Upper curve: average of first twelve 18.2-year cycles (1514--1731), smoothed and repeated in phantom.

Lower curve: average of next eleven 18.2-year cycles (1732--1929), smoothed and repeated in phantom.

THE 17 3/4-YEAR CYCLE IN STOCK PRICES 1831—1954

STOCK prices from 1831 to 1905 were dominated by a cycle from 16 1/2 to 18 years long. However from 1905 to date any such cycle has been missing, or at least badly distorted.

The Data

The data used for this study are charted in Fig. 1 on the two pages next following. For the period 1871—1954 they consist of the Standard & Poor's Corporation Combined Index 1935-39 = 100. For the period 1854—1871 they consist of the Clement Burgess Index adjusted to be comparable with the Standard & Poor's Index. For the period 1831—1854 they consist of the Cleveland Trust Company Rail Stock Price Index adjusted to be comparable with the adjusted Clement Burgess Index.

The Trend

Trend, also shown in Fig. 1, is a straight line, fitted to the logs of the data by means of least squares.

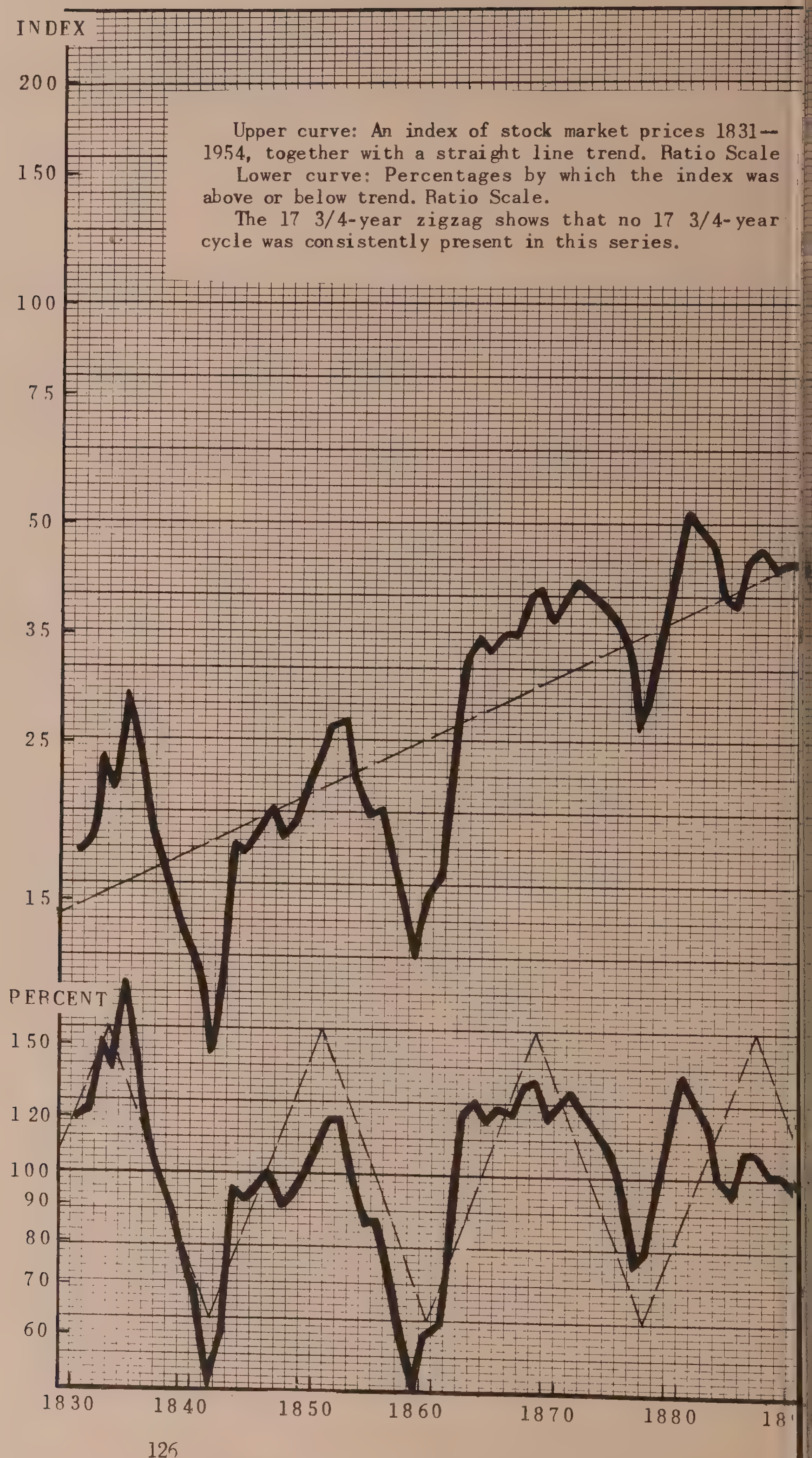
The percentages by which actual prices are above or below trend are also shown in Fig. 1. A 17 3/4-year cycle has been diagrammed by means of a broken zigzag line.

The Cycle

Looking at these percentages it is clear that the main oscillations from 1831 to 1905 did in truth tend to fluctuate in a 16 2/3- to 17 3/4-year cycle. However, from 1905 forward it takes a very high order of wishful thinking to see any continuation of the pattern.

Conclusions

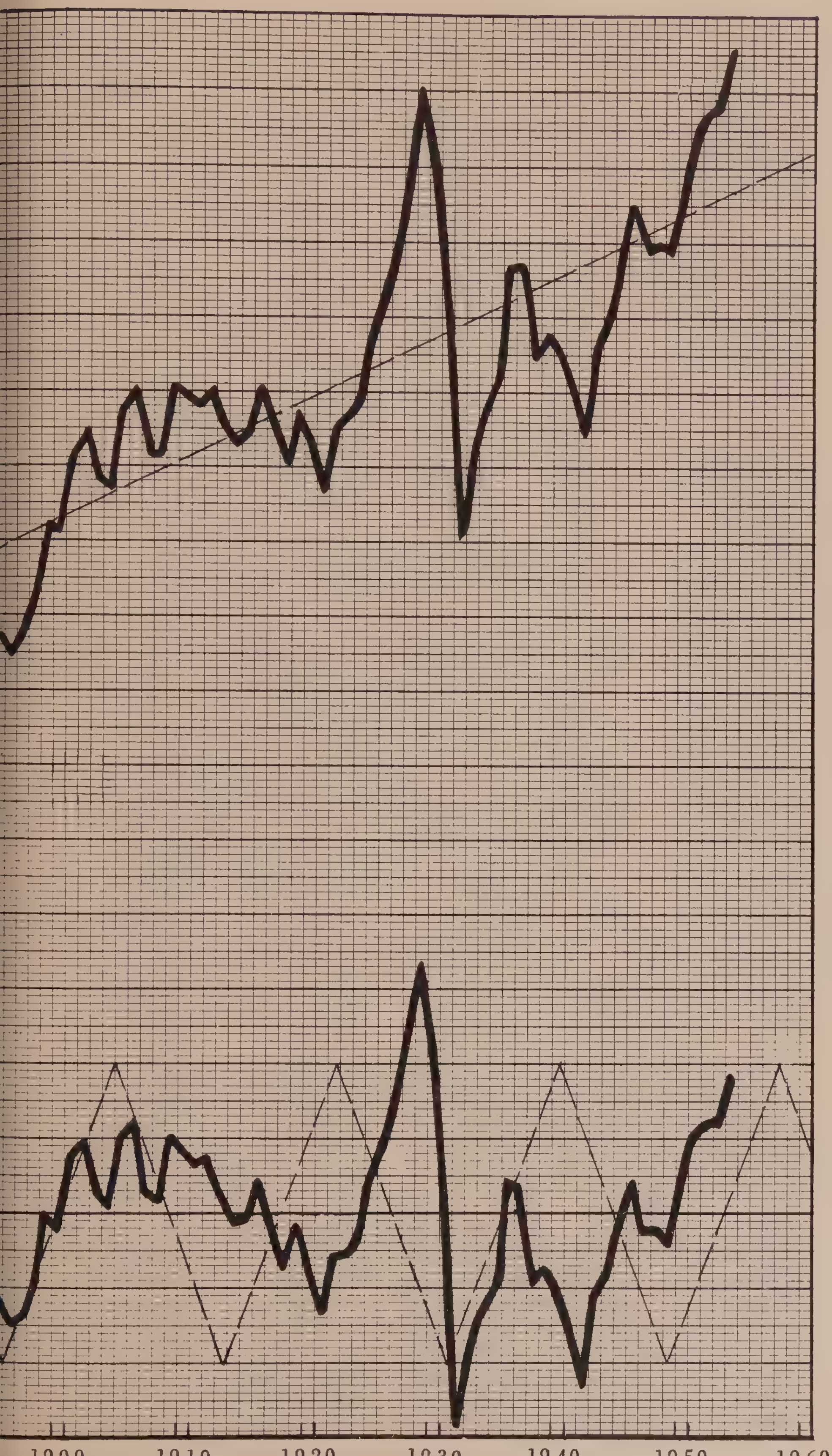
For my part, I fail to be convinced that either a 17.7- or an 18.2-year cycle exists as an important factor in stock prices at the present time.



Upper curve: An index of stock market prices 1831—1954, together with a straight line trend. Ratio Scale

Lower curve: Percentages by which the index was above or below trend. Ratio Scale.

The 17 3/4-year zigzag shows that no 17 3/4-year cycle was consistently present in this series.


1900
1910
1920
1930
1940
1950
1960

THE 17 3/4-YEAR CYCLE IN ARIZONA TREE RINGS, A.D. 931–1939

ARIZONA tree rings (A.D. 931--1939) are wider and narrower in a cycle which, on the average, in each half of the data, is about 17 3/4 years long.

The Data

The data used are measurements of the widths of the annual rings of an overlapping series of specimens of wood taken from trees in the northeastern part of Arizona. These measurements were made by Harold Gladwin and are correct to the nearest .05 mm.[1]

The 17 3/4-Year Cycle

The 17 3/4-year cycle in these figures is not strong enough to dominate a chart of these tree ring widths. One is therefore forced to rely on the evidence provided by a periodic table. That is you must assume a particular length, such as 17 3/4 years, and average a number of 17 3/4-year sections of the data (three 18-year sections and one 17-year section, and repeat). This averaging process has no effect upon any regular 17 3/4-year cycle that may be present in the series of figures—and very little effect upon any cycle close to this length—but the process does tend to minimize the randoms and other cycles. As more and more sections of the data are averaged together the cycle begins to emerge, if it is there.

To minimize randoms still further the data (in logs) were expressed as deviations from trend. The trend used was a 23-year moving average of the logs of the data. Deviations were also limited to 2.200 and 1.800.

The average cycles in each half of the series disclosed by these methods were smoothed by 9- and 6-year moving averages to remove the half and third harmonics of 17 3/4-years also seemingly present on the average in this series. The results are shown in Fig. 1 below.

The fact that the cycle present on the average in the second half of the periodic table falls directly under the cycle present on the average of the first half of the table as shown in Fig. 1 below, suggests that the cycle is very close to 17 3/4 years in length.

Ideal time for the current crest of this cycle in these figures is 1961.7. Amplitude (before smoothing) is 104.0% of trend at crest, 96.3% of trend at trough.

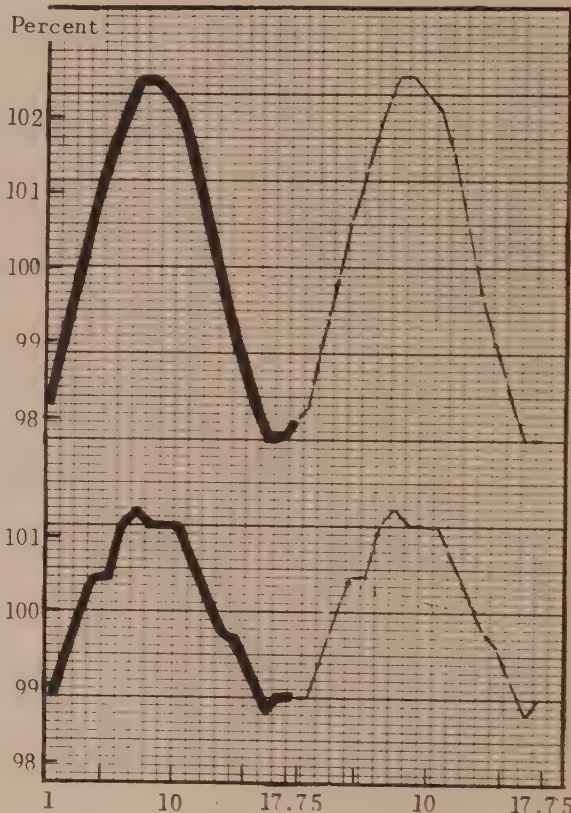


Fig. 1. The 17.75-Year Cycle in Arizona Tree Rings, A.D. 931--1939.

Upper curve: average of the first twenty-eight 17 3/4-year cycles (941--1420), smoothed and repeated in phantom. Ratio Scale.

Lower curve: average of the second twenty-eight 17 3/4-year cycles (1421--1935), smoothed and repeated in phantom. Ratio Scale.

Unsmoothed figures have 2.3 times the amplitude shown.

References

1. Gladwin, H. S., "Cycle Data: Measurements of Tree Ring Widths in the Lukachukai District of Arizona, 54 B.C.—1939 A.D." Basic Data Bulletin No. 2, Foundation for the Study of Cycles, *Cycles*, Vol. II, No. 5, pp. 195-200, May 1951.

THE 18.2-YEAR CYCLE IN OTHER PHENOMENA[1]

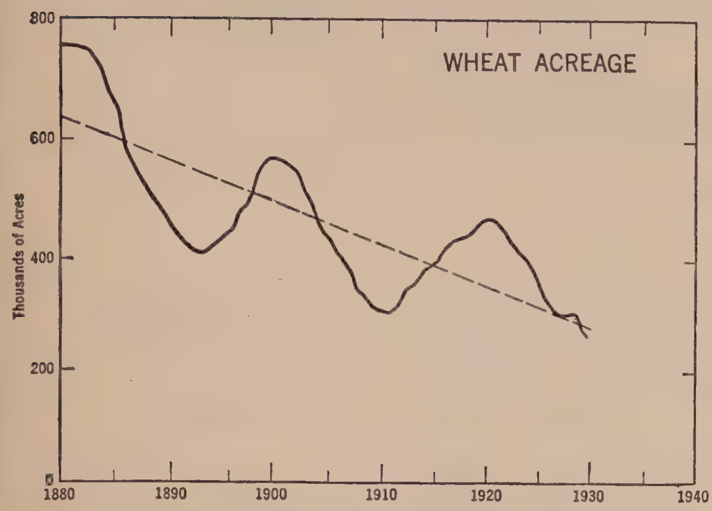


FIG. 4. THE 18⅓-YEAR RHYTHM IN WHEAT ACREAGE

Acreage planted to wheat in New York, 1880–1930. (After Warren and Pearson and King.)

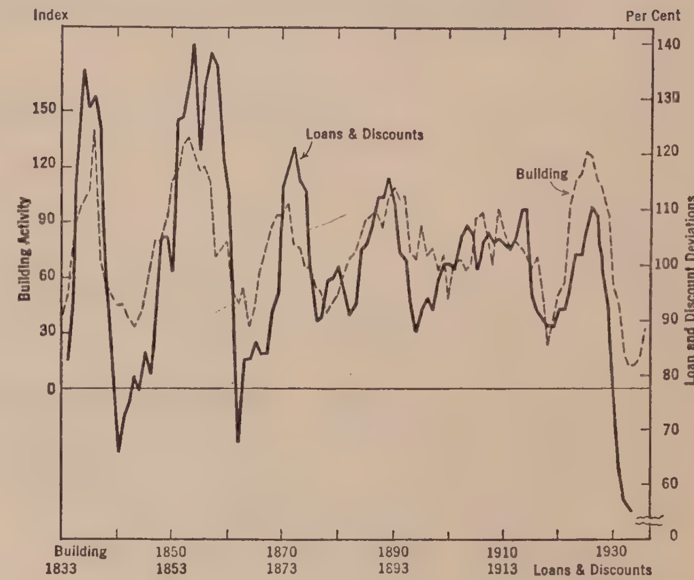


FIG. 10. THE 18⅓-YEAR RHYTHM IN LOANS AND DISCOUNTS

Variations in the volume of loans and discounts, 1833–1936, expressed as a percentage of normal, and set back three years to correspond with the Composite – Riggleman, Wenzlick, and 120-City-Index of building activity, 1830–1936 (after Warren and Pearson).

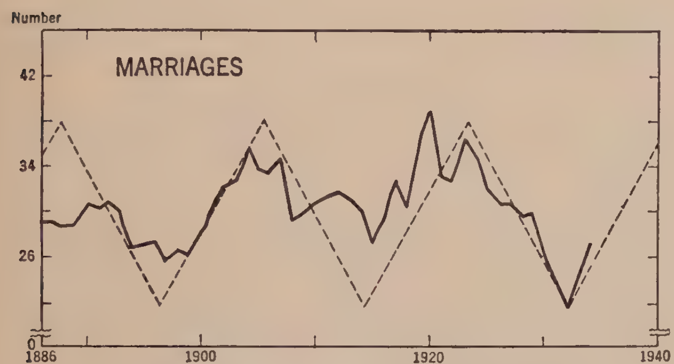


FIG. 3. THE 18⅓-YEAR RHYTHM IN MARRIAGES

Marriages per 10,000 adult males in greater St. Louis, 1886–1934. (After Warren and Pearson. Data by Roy Wenzlick in the *Real Estate Analyst*.) A regular 18⅓-year cycle has been added.

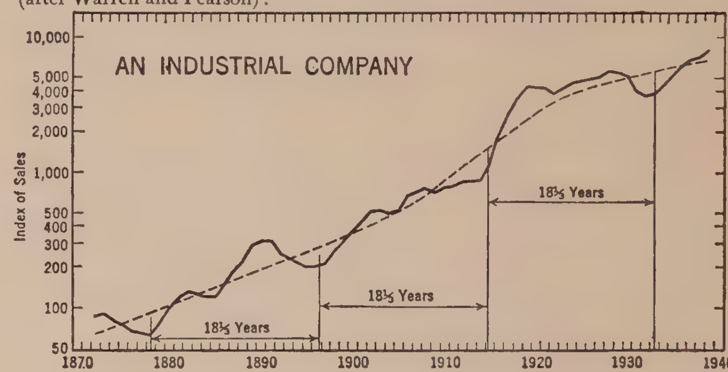


FIG. 14. THE 18⅓-YEAR RHYTHM IN THE SALES OF AN INDUSTRIAL COMPANY

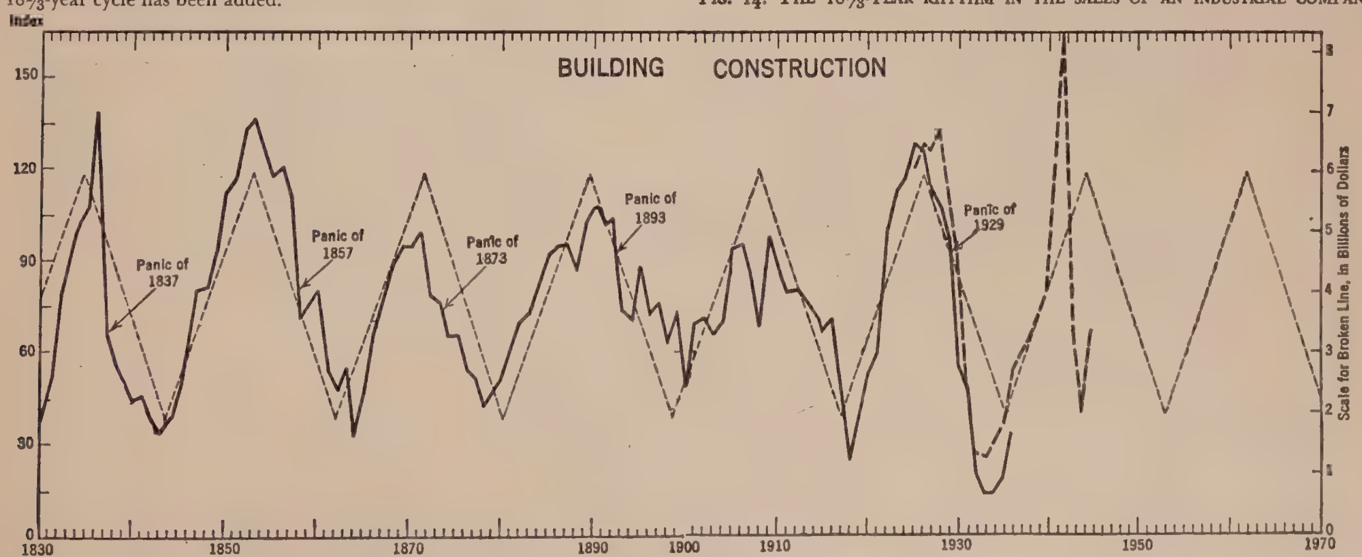


FIG. 2. THE 18⅓-YEAR RHYTHM IN BUILDING ACTIVITY

Building activity in the United States, 1830–1936. The Composite – Riggleman, Wenzlick, and 120-City-Index of building activity. (After Warren and Pearson.) Value of construction contracts awarded in thirty-seven states, F. W Dodge Corporation, 1925–1945. A regular 18⅓-year cycle has been added, and projected to 1970 to show approximately what will happen if this rhythm continues

1. DEWEY, E. R. AND DAKIN, E. F., *Cycles, The Science of Prediction*, NEW YORK, 1949

THE 17.7- AND 18.2-YEAR CYCLES NOT PRESENT IN VARIOUS PHENOMENA

Wrought Iron Prices in England, A.D. 1277--1918

A study of wrought iron prices in England, 1277--1918,[1] failed to reveal any cycles between 17 2/3 and 18 1/3 years in length. This was a surprise, for the 17.7 year cycle in pig iron prices in the United States is well defined.

Flood Stages of the River Nile, A.D. 622--1921

A study of maximum annual stages of the Nile River at the Roda gage, Cairo, Egypt, A.D. 622--1921,[2] failed to reveal any cycles between 17 2/3 and 18 1/3 years in length.

Population of the United States, 1790--1952

A study of estimates of annual population of the United States, 1790--1952,[3] fails to reveal any cycles in the 17 2/3-18 1/3 year range. This fact would tend to disprove the theory that the 18 1/5 year building cycle results from periodic upsurges of population growth.

Immigration into the United States From All Countries, 1820--1952

A study of immigration into the United States, 1820--1952,[4] fails to reveal any cycles in the 17 2/3 or 18 1/3-year range.

Varve Thickness of Lake Sakski, 2295 B.C.--A.D. 1894

A study of variations in the thickness of sedimentary rock deposits of Lake Sakski 2295 B.C. through A.D. 1894[5] failed to show any cycles between 17 2/3 and 18 1/3 years in length.

Copper Prices in the United States 1784--1952

No hint of any cycle 17 2/3 to 18 1/3 years long was found in studies of both quarterly and annual copper prices in the United States, 1784--1952.[6]

References

1. Elmes, Cecil F., *Appraisals and Rate Making*, Sanderson and Porter, New York, 1919.
2. Jarvis, C. S., "Flood Stage Records of the River Nile," *Journal of Cycle Research*, Vol. II, No. 4, pp. 96--100.
3. *Historical Statistics of the United States, 1789--1945*, (and its *Continuation to 1952)*, Series B-31, p. 26, U. S. Dept. of Commerce, Washington, D. C. 1949 and 1954.
4. *Ibid.* Series B-304, p. 33.
5. Schostakowitsch, W. B., "Bodenablagerungen der Seen und periodische Schwankungen der Naturerscheinungen." Leningrad, Mem. Hydr. Inst., 13, 1934, pp. 95-140, as abstracted July 1935 by C. E. P. Brooks.
6. Dewey, Edward R., "An Index of Copper Prices in the United States, 1784--1952," unpublished manuscript in the files of the Foundation for the Study of Cycles, 1953.

NOTICE

THIS VOLUME IS INCOMPLETE

THE FOLLOWING ISSUES ARE ON ORDER:

Vol. 4 no. 3-4 (1955)

NOTICE

THIS VOLUME IS INCOMPLETE

THE FOLLOWING ISSUES ARE ON ORDER:

Vol. 5-8 (1956-1959)